LUME XVII MARCH, 1917 NUMBER 3

3 10.5
A5
v.17

APR 27 1917
UNIV. OF MICH. LIBRARY

THE AMERICAN MUSEUM JOURNAL

AZTEC DISCOVERIES — RUINS OF TULOOM

ORIGIN OF AGRICULTURE IN AMERICA

A STORY FROM THE HIGH ANDES

A FOSSIL DEER —— THE EULACHON

50 A YEAR 20 CENTS A COPY

The American Museum of Natural History

BOARD OF TRUSTEES

President
HENRY FAIRFIELD OSBORN

First Vice-President
CLEVELAND H. DODGE

Second Vice-President
J. P. MORGAN

Treasurer
HENRY P. DAVISON

Secretary
ADRIAN ISELIN, JR.

JOHN PURROY MITCHEL, MAYOR OF THE CITY OF NEW YORK
WILLIAM A. PRENDERGAST, COMPTROLLER OF THE CITY OF NEW YORK
CABOT WARD, PRESIDENT OF THE DEPARTMENT OF PARKS

GEORGE F. BAKER
FREDERICK F. BREWSTER
JOSEPH H. CHOATE
R. FULTON CUTTING
THOMAS DEWITT CUYLER
JAMES DOUGLAS
HENRY C. FRICK
MADISON GRANT
ANSON W. HARD
ARCHER M. HUNTINGTON
ARTHUR CURTISS JAMES
WALTER B. JAMES
A. D. JUILLIARD
CHARLES LANIER
OGDEN MILLS
PERCY R. PYNE
JOHN B. TREVOR
FELIX M. WARBURG
GEORGE W. WICKERSHAM

ADMINISTRATIVE OFFICERS

Director
FREDERIC A. LUCAS

Assistant Treasurer
THE UNITED STATES TRUST COMPANY OF NEW YORK

Assistant Secretary
GEORGE H. SHERWOOD

SCIENTIFIC STAFF

FREDERIC A. LUCAS, SC.D., Director

Geology and Invertebrate Palæontology

EDMUND OTIS HOVEY, Ph.D., Curator
CHESTER A. REEDS, Ph.D., Asst. Curator

Mineralogy

L. P. GRATACAP, A.M., Curator
GEORGE F. KUNZ, Ph.D., Honorary Curator Gems

Woods and Forestry

MARY CYNTHIA DICKERSON, B.S., Curator
BARRINGTON MOORE, A.B., M.F., Assoc. Curator

Invertebrate Zoölogy

HENRY E. CRAMPTON, Ph.D., Curator
ROY W. MINER, A.B., Assoc. Curator
FRANK E. LUTZ, Ph.D., Assoc. Curator
L. P. GRATACAP, A.M., Curator Mollusca
A. J. MUTCHLER, Assistant
WILLARD G. VAN NAME, Ph.D., Assistant
FRANK E. WATSON, B.S., Assistant
W. M. WHEELER, Ph.D., Hon. Curator Social Insects
A. L. TREADWELL, Ph.D., Hon. Curator Annulata
CHARLES W. LENG, B.S., Hon. Curator Coleoptera

Ichthyology and Herpetology

BASHFORD DEAN, Ph.D., Curator Emeritus
JOHN T. NICHOLS, A.B., Asst. Cur. Recent Fishes
MARY CYNTHIA DICKERSON, B.S., Assoc. Curator Herpetology

Mammalogy and Ornithology

J. A. ALLEN, Ph.D., Curator
FRANK M. CHAPMAN, Sc.D., Curator Ornithology
ROY C. ANDREWS, A.M., Asst. Cur. Mammalogy
W. DEW. MILLER, Asst. Curator Ornithology
H. E. ANTHONY, B.S., Assistant Mammalogy
HERBERT LANG, Assistant Mammalogy
JAMES P. CHAPIN, A.B., Assistant Ornithology

Vertebrate Palæontology

HENRY FAIRFIELD OSBORN, LL.D., D.Sc., Curator Emeritus
W. D. MATTHEW, Ph.D., Curator
WALTER GRANGER, Assoc. Curator [Mammals]
BARNUM BROWN, A.B., Assoc. Curator [Reptiles]
WILLIAM K. GREGORY, Ph.D., Assoc. in Palæontology
CHARLES R. EASTMAN, Ph.D., Research Associate

Anthropology

CLARK WISSLER, Ph.D., Curator
PLINY E. GODDARD, Ph.D., Curator Ethnology
ROBERT H. LOWIE, Ph.D., Assoc. Curator
HERBERT J. SPINDEN, Ph.D., Asst. Curator
N. C. NELSON, M.L., Asst. Curator
CHARLES W. MEAD, Asst. Curator
M. D. C. CRAWFORD, Research Associate in Textiles
GEO. BIRD GRINNELL, Ph.D., Research Associate in Ethnology
J. HOWARD MCGREGOR, Ph.D., Research Associate in Anthropology
LOUIS R. SULLIVAN, A.M., Assistant Physical Anthropology
LESLIE SPIER, B.S., Assistant Anthropology

Anatomy and Physiology

RALPH W. TOWER, Ph.D., Curator
CHARLES F. HERM, Assistant
ALESSANDRO FABBRI, Research Associate in Physiology

Public Health

CHARLES-EDWARD A. WINSLOW, M.S., M.A., Curator
THOMAS G. HULL, Ph.D., Assistant

Public Education

GEORGE H. SHERWOOD, A.M., Curator
G. CLYDE FISHER, Ph.D., Asst. Curator
ANN E. THOMAS, Ph.B., Assistant

Books and Publications

RALPH W. TOWER, Ph.D., Curator
IDA RICHARDSON HOOD, A.B., Asst. Librarian

CONTENTS FOR MARCH

Cover, Entrance to the Harbor, Rio de Janeiro, Brazil

Photographed from an elevation of 1400 feet, by Leo E. Miller

Frontispiece, Drifting Clouds Among High Andean Peaks..... 156

Photographed by Leo E. Miller

A Search for *Scytalopus*.....LEO E. MILLER 157

A journeying through many hundreds of miles by the South American Expedition of the American Museum, and a final discovery of the small, elusive bird, *Scytalopus*, valuable to science
Illustrations from photographs by the Author

Discoveries at the Aztec Ruin.....EARL H. MORRIS 169

A description of ancient Pueblo relics from New Mexico, from which can be constructed a mosaic of the life and customs of the past
Illustrations from specimens in the American Museum

The Invention and Spread of Agriculture in America.....HERBERT J. SPINDEN 181

The world's indebtedness to the American Indian for achievements in the domestication of many of our common food plants of today
Photographs from pottery in the American Museum. Decorative motives from Copan and Palenque showing Maya maize gods, and map of pottery distribution and agriculture, from drawings by the Author
Article followed by a note by Dr. Spinden on the greater use of Indian foods, a timely suggestion on the extension of our food supply

The Ruins of Tuloom, Yucatan.....SYLVANUS GRISWOLD MORLEY 191

The visit of the Carnegie Institution Central American Expedition to an important Maya city, long rendered inaccessible by hostile Indians
Illustrations from photographs and drawings by the Expedition, including detail in two colors from mural paintings portraying Maya deities, the sun god and the god of rain and fertility, from a temple at Tuloom

The Eulachon—and its Kindred.....DAVID STARR JORDAN 205

A delicious food fish from the Pacific Coast, which is making "a nick in the high cost of living in the Northwest"

A Fossil Deer from Argentina.....W. D. MATTHEW 207

A contemporary of the ground sloths from the Pampean formation near Buenos Aires, with a discussion of various types of deer in North and South America

A Forgotten Naturalist.....FREDERIC A. LUCAS 211

Brief mention of the work of Titian Ramsay Peale

Museum Notes..... 212

MARY CYNTHIA DICKERSON, *Editor*

Subscriptions should be addressed to the AMERICAN MUSEUM JOURNAL, 77th St. and Central Park West, New York City.

The Journal is sent free to all members of the American Museum.

DRIFTING CLOUDS AMONG HIGH ANDEAN PEAKS

Each morning the bleak *paramos*, above timber line in the Andes, are covered with clouds, through which the lofty mountain peaks stand forth like islands in an ocean of foam. The work of the expedition in this region was done under disadvantages, for in addition to the intense cold and the lack of fuel, there was always the possibility of being trapped far from camp by the unexpected rolling in of these banks of clouds. There is nothing to do, when thus "lost" in the cold, dense mist, but wait the long hours until it is lifted

THE AMERICAN MUSEUM JOURNAL

VOLUME XVII MARCH, 1917 NUMBER 3

A Search for *Scytalopus*

By LEO E. MILLER

Leader of the American Museum's South American Expedition, 1915–1916 [1]

Illustrations from photographs by the Author

THE little wrenlike birds of the genus *Scytalopus,* known commonly as "tapacolos," are perhaps among the most difficult to collect of any species in South America, and for this reason they are invariably only poorly represented in museum collections. Native collectors, hunting mainly with blowguns, have gathered many thousands of birds, the greater number of which have eventually found their way to millinery establishments and scientific institutions in many parts of the world; but usually only those of brilliant plumage, and others which could be taken with little difficulty, have been collected. The small, slate-colored or blackish tapacolos, found only in the densest of subtropical forests or among the tangled vegetation bordering bleak, frigid *paramos,* have usually been overlooked. This is not to be wondered at when we find how seldom even the trained field naturalist of today finds it possible to lure the tiny, feathered creature from its secure retreat among the mosses, roots, and ferns to which its mouselike habits confine it, and how rarely he succeeds in recovering the inconspicuously colored bird after it has been shot. Even after a long, patient search has revealed the specimen lodged somewhere in the deep stratum of matted plants, it is by no means sure of reaching the museum; I have heard of instances where birds, slipping from the hunter's hands and dropping at his feet, have been forever lost in the riot of vegetation which carpets the ground.

After completing eight months' work in Bolivia, the expedition started for the Argentine Republic. Sucre had been our headquarters for a number of weeks, and to reach La Quiaca, on the Argentine frontier, it was necessary to traverse the high Bolivian plateau a distance of more than three hundred miles.

During the dry season motor cars are run from Sucre to Potosí in one day's time. A railroad connects the latter place with a small station a short distance this side of Tupiza, and from this point one may reach La Quiaca via carriage in two days. During the rainy season, however, both automobile and carriage service are suspended; and the difficulty of twice securing mules on which to cover the two stretches of road between railway terminals, and the delays and other inconveniences, are so great that we decided to travel the entire distance by

[1] Mr. Howarth S. Boyle, assistant in the American Museum, accompanied Mr. Miller on the South American Expedition, 1915–1916

pack train. This also gave us an opportunity to see the country.

The expedition left Sucre December 22 (1915). We had engaged an adequate caravan of mules and burros and a number of Quichua drivers for the journey. All supplies had to be taken with us, as very little in the way of provisions may be had from the Indians who are virtually the sole inhabitants of the cheerless highlands. There are a number of villages, it is true, but the person who relies upon them for maintenance must either live on coca and *chicha,* the native beer, or meet with disaster. The country is rolling, dry, and unproductive. In places there is a sparse growth of cacti and thorny shrubbery, but vast areas are rocky and barren of all vegetation. We crossed ridge after ridge, the elevation of the trail varying between eight thousand and twelve thousand feet. Travel in this type of country is most trying. Water is so scarce that long distances must be covered in order to find suitable camping sites; in one instance we were compelled to ride thirty-six miles in the course of a day, between streams. The temperature varies one hundred degrees each twenty-four hours. At two in the afternoon the thermometer registered 132° F. in the sun; at night it dropped to 32°.

After twelve days, two of which had been spent in a Quichua village called Puna, with every member of the party suffering from sunburn or mountain sickness, we reached Villazón on the Bolivian side of the border. Villazón contains about a score of scattered, low, adobe buildings. We arrived on a Sunday, when the custom house was closed, but the officials in charge very courteously permitted us to proceed on our way. A brook three or four feet wide separates the two republics, and stepping across this, we found ourselves in La Quiaca, a village of Argentina very similar to Villazón.

This section of the Argentine is rich in mines, and multitudes of llamas and mules came down from the mountains each day, laden with copper, bismuth, silver ore, and gold ore. They discharged their burden at the railroad station where it was loaded on cars to be taken to the smelters in Buenos Aires.

Our object in coming to the Argentine was to continue the biological survey we had carried on in Bolivia; and also to secure specimens of a species of *Scytalopus* which was thought to exist in the province of Salta. The acquisition of this bird was most important for the light it would throw on certain problems of distribution. We therefore took the first available train and started southward.

From La Quiaca the railroad winds upward through a narrow, rocky gorge to the station Tres Cruces, the altitude of which is 12,400 feet. Then it descends at a steep grade—so steep in fact that a rack and pinion are used part of the distance.

Our first headquarters were made at Rosario de Lerma, near the city of Salta. We had been informed that the town was in the center of a heavily forested region, but found upon our arrival that it was surrounded by cultivated fields, pastures, and a few clumps of open, low woods. The attractiveness of the region, however, cannot be exaggerated, and the courtesy of the inhabitants will always remain one of the bright spots of our many years' experience in South America. Birds were most abundant also. They were nesting, so that it was possible to secure not only a large amount of un-

usually interesting material, but a great deal of information about their life histories as well.

Using Rosario de Lerma as a base, we made a number of excursions into regions several hundreds of miles distant, in the hope of finding the dense forest which we thought would shelter the bird we were seeking. One of these was to the *chaco,* far to the east. In this place we found rheas, which are still fairly abundant in spite of the persecution to which they have been subjected. These birds were nesting, and the eggs were commonly sold in the village markets at about twenty cents apiece. As the contents of each egg is equal to that of a dozen hen's eggs, and the quality is fully as good, this price is not exorbitant. As a rule a single nest contains eight to fifteen eggs, but we heard of one instance in which twenty-four were found, and this number is about as many as one man can carry.

The city of Tucuman was our next objective. Our first care was to secure a collecting permit as the hunting season had not yet opened. Each province, it seems, has its own game laws so that it was necessary to secure a separate permit every time we moved from one locality to another. In this we had so far been successful, but in Tucuman we faced an extraordinary situation, and it seemed impossible to secure the permits. As a last resort I appealed to the British consul (there being no American consul in Tucuman), who very kindly spent a great many hours in attempts to explain our mission, but all his efforts were in vain. Our quest seemed hopeless until one day a copy of one of the large daily newspapers of Buenos Aires arrived, and in this I found a lengthy account of how representatives of Latin-American countries who were attending the scientific congress in Washington had been received and entertained at the American Museum of Natural History during their visit to New York. Armed with this account I again called at the palace. Ordinarily I should not have thought of such a move, as there are many reasons why it is not commendable; but the situation was desperate. Suffice it to say that this visit was the last, for when I left the building the permit was in my pocket.

A range of comparatively low mountains rises directly west of Tucuman. This we found to be covered with a growth of tall, dense forest, so we lost no time in going there. We left the city by rail and proceeded southwestward to a little station called San Pablo, a short distance away. This is in the heart of the sugar region, and vast fields of cane stretch on either side of the railway. Here and there the tall, brick chimneys of a refinery rise above the waving green of the fields, and wide, deep canals divide the cultivated areas into sections and supply water for irrigation.

A good cart road leads from San Pablo, up the side of the mountains to the very summit, four thousand six hundred feet high, where the little town of Villa Nougués is situated. The settlement is a favorite resort of the wealthier class of people who come up from Tucuman to spend the summer months in pleasant chateaux, thereby avoiding the great heat of the lower country. The view from the top of the range is superb; the country to the east is perfectly level, and is laid out in symmetrical fields of cane as far as the eye can see. A small, muddy river, threading its way through the ocean of green, divides it into two sections and vanishes into the horizon in a haze of

Expedition on the march over the highland of Bolivia. The temperature in this region, which is between ten thousand and twelve thousand feet high, varied one hundred degrees each twenty-four hours

In Tucuman, Argentina, the cows are driven from door to door, and milk is delivered fresh to customers

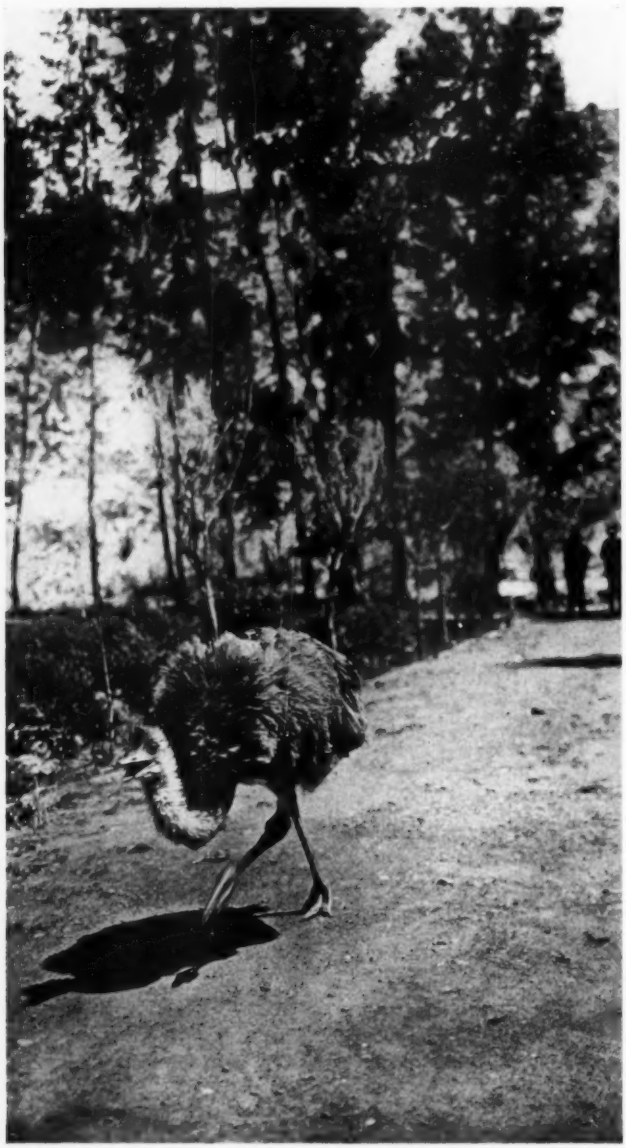
Because the slope of the mountains is gentle, it is possible to use carts between Sucre and Potosí, a journey of four or five days

The Quichua Indian village of Puna is built entirely of adobe. It seems as if a heavy rain would wash all the structures away, but they are nevertheless able to withstand climatic conditions for a number of years

The railroad between La Quiaca and Salta, Argentina, runs through a narrow, rocky gorge flanked by high, barren hills, over the tops of which may be seen the snow-crowned peaks of the Andes

purple mist. To the west rises the stern Andean chain, barren and precipitous, its top hidden in banks of grayish clouds.

We made a first camp in the forest below Villa Nougués, at an altitude of four thousand feet. From the very first day we heard a shrill little call which we thought belonged to *Scytalopus;* but the elusive bird always remained in concealment among the ferns and mosses, and not once did we get a glimpse of it. Then we moved to the other side of the mountain where, we had been told, hunting was not so difficult.



In spite of the hundreds of thousands of rheas killed for their feathers, which are used in making dusters, these great birds are still fairly abundant in Argentina. Their eggs sell in the local markets for about twenty cents apiece, not an exorbitant price for an egg which equals a dozen hen's eggs in size and probably in food value

Birds were not abundant, the fall migrations having left the forest almost deserted. The few species which remained, however, such as wood hewers, thrushes, tanagers and jays, were plentiful, and several species of humming birds lent color and life to the somber green of the vegetation. After many days, we succeeded in tracing the mysterious chirp to its source, and found, not the bird we were seeking, but a dainty little wood wren of the shyest possible nature. The minute, secretive creature seemed to spend its entire time among the buttressed roots and moss-draped undergrowth, where no ray of sunlight ever penetrated to dispel the chill and semi-darkness, or give a touch of cheer to the

soggy mould. Its glimpses of daylight must be brief indeed, and at infrequent intervals.

We had come to the mountains in a state of enthusiasm and expectancy, for here it seemed we should succeed in ending our long quest. As the days passed, thrilling excitement gave way to exasperation; and finally, disappointment alone remained to fill the void created by the flight of the other emotions.

We returned to Tucuman to pack the collections which had been made, and then struck for the forest farther south. This time we left the railroad at a station called Aguilares, two and one half hours from Tucuman, and camped in the forest at the foot of the ridge. Again we were doomed to disappointment. Birds were more abundant than at Villa Nougués, but the tapacolo was not forthcoming. As a last resort it was therefore decided to visit the top of the range, which at this point attains an altitude of over ten thousand feet. This necessitated the securing of a pack train of mules, but the matter was arranged, and one morning at one o'clock we mounted and started up the slope. A full moon showered a flood of light upon the earth, but the overhanging branches formed a thick canopy over the trail, impermeable to the silvery radiance save when an occasional breeze stirred the leafy arch, thus permitting fitful shafts of light to pierce the darkness of the tunnel, and to fall in quavering, dancing blotches on the ground. We

Llamas, laden with potatoes and other produce, and driven always by Quichua Indians, frequently come down from the highlands into the streets of Sucre. The limit of the llama's load is about one hundred pounds. If it be given a heavier burden, it will lie down and stubbornly refuse to move

could almost feel the impenetrable blackness which closed in from all sides like water in a deep, dark pool. The light touch of a streamer dangling from the moss-festooned branches overhead, or the velvety swish of fern leaves protruding beyond the protecting walls of tree-trunks, made it seem as if the forest were peopled with hovering, invisible forms. No sound disturbed the brooding silence of the night, except the dull hoof-beats of the mules, as, guided by some mysterious instinct, they cautiously picked their way through the muddy and rock-strewn lane.

Hour after hour we followed blindly in the wake of the bell-mule, winding back and forth along the mountain-side, but mounting ever upward. The latter part of the way seemed to lie near the course of a small mountain torrent, for we were almost constantly within hearing distance of rushing water. Finally, we emerged from the forest, and, just as day was breaking, reached a brush-covered strip of country, the elevation of which is five thousand feet. This continued to the top of the ridge, two thousand feet above. Then there was a depression of considerable extent, filled with rank, low vegetation and infested with swarms of bloodthirsty flies which render it uninhabitable.

After ascending another ridge, the trail led gently downward into a level valley a dozen miles long and from one to two miles wide. Herds of cattle were grazing on the abundant grass; a few small areas had been enclosed within stone walls and planted in maize; and at the far end, half-concealed by willows and fruit trees, lay a village of whitewashed houses. At half past four in the afternoon we reached the settlement, called Tafí del Valle, and soon after were comfortably

On account of the abundance of moisture in the Cloud Forest of the Andean slopes, the trees are covered with mosses, and their branches form aërial gardens of orchids, ferns, and parasitic plants. It was through this deep, dark tangle, to which the rays of the sun never penetrate, that the expedition made the ride at night on the search for *Scytalopus*

Bush-covered fissures in the cold *paramo* slopes above Tafí del Valle, Argentina. It was in this desolate spot that *Scytalopus* was finally discovered

ensconced in a hut hospitably provided by one of the inhabitants. After the fifteen and a half hours' uninterrupted ride over a difficult trail we were ready for a journey into a still more remote region, and the sun was shining brightly the following morning when we again returned to the stern realities of this world.

Tafí del Valle is a most delightful place. Even though the altitude is seven thousand feet, the surrounding peaks shut in the valley and protect it from the icy winds. There is no natural forest in this region, but groves of willows have been planted near the houses; to these, large numbers of birds came to spend the night. Hawks were especially abundant and of many kinds—we collected no fewer than seventeen species during our ten days' stay; then there were also burrowing owls, larks, flycatchers, thrushes, and many other birds. Some species which ordinarily live in brush-covered country had become adapted to their barren surroundings and were nesting in holes excavated in banks of earth. When the birds had reared their broods, rats, mice, and pigmy opossums occupied the old nesting sites.

A clear, cold stream, which flows through one side of the valley, spreads out at the lower end over a large area, forming lagoons and marshes. Geese, ducks, coots, night herons, and sandpipers made these places a favorite resort. Pectoral sandpipers were not uncommon, and were so fat that they were unable to fly and could be taken with the hands. There were also flocks of stilts; they are beautiful creatures, either when flying in compact formation, with measured wing-beats and outstretched necks and legs, or when standing motionless in the shallow

water, their snowy underparts reflected in quivering outlines. Lapwings screamed and cackled in resentment of our visit and frequently frightened away flocks of waterfowl which we were stalking.

Apparently our *Scytalopus* was not a bird of the open highlands. We even began to wonder if it existed at all, because, so far, the most thorough search had failed to reveal any trace of it. There remained, however, the high *paramo* above, and to this we next turned our attention.

Our sudden arrival at Tafí had caused much comment among the inhabitants. They found it impossible to believe that we had come to that remote region in search of a small, dull-colored bird, and after a few days it became an open secret that we were regarded as spies—though just what nature of information we sought, could not be determined. They even went so far as to refer to the matter occasionally in a good-natured manner; and when we were away on hunting excursions, it was the custom to put our cook, a Bolivian, through a sort of "third degree" in an effort to compel him to confess the real object of our visit. Therefore, when we planned to move to the high peaks bordering the little valley, the natives considered their evidence complete; we were going, they said, to prepare a diagram of the country from our new point of vantage. The only person who really understood the purpose of our mission was a man from Tucuman who had been sent up to vaccinate the Indians. He started out each morning accompanied by two or three soldiers, rounded up all the Indians of a given locality, and vaccinated them. The natives did not at the time realize the significance of this act; but when, a few weeks later, the inoculations had had time to become effective, they grew frantic, and grim-faced little parties began to scour the country in search of the person who had "poisoned" them. Fortunately, none of the scouting parties came our way, for to them all strangers look very much alike, and there was the possibility that one of us might have been mistaken for the doctor.

The *paramo* above Tafí is a bleak region, almost perpetually enveloped in mist. Work in this type of country possesses its disadvantages, for in addition to the intense cold and the lack of fuel, there is always the possibility that one may be trapped far from camp by banks of clouds which roll in unexpectedly! The cold, penetrating mist is so dense that it is impossible to distinguish objects but a few yards away, and the most familiar landmarks assume strange and fantastic outlines. In the event that one is overtaken by this phenomenon, there is nothing to do but wait until the mist lifts, which may be in a few hours, or perhaps, not until the next day. Strange to say, the inhospitable *paramo* supports a varied fauna. Herds of wary guanacos feed on the tall, wiry grass growing in the more sheltered places; when alarmed, they flee to the inaccessible rocky slopes. The *paja,* or grass, harbors also a species of large tinamou, but the bird is loath to leave its safe cover, for no sooner does it take wing than hawks, which are always hovering about, swoop down and carry it away.

Numbers of deep ravines have been worn in the mountain-sides by water coming from the melting snows on the higher peaks. These are filled with a rank growth of shrubbery. The sides are so abrupt that we could find no spot where a descent was possible without the aid of a thousand feet or more

of rope. After a number of days, however, a narrow fissure was discovered leading to one of the ravines from which came faint bird calls that we at once recognized with a fair degree of certainty. On account of the high altitude and tangled plant life it was slow, tiring work to follow along the bottom of the jagged gash; there was also the unpleasant possibility of breaking through the matted brush and falling into deep crevices among the rocks.

As we struggled along slowly, high-pitched whistling calls rang clear and loud from numerous points nearby, but still it seemed as if our efforts might be of no avail; for among that chaos of vegetation it was impossible to move without causing great disturbance and frightening the birds away. Then there recurred to us the old saying about Mahomet and the mountain and we resorted to quiet concealment.

Presently there was a crisp little chirp and a rustle among the mosses a few yards away; one, two, five minutes passed; then a minute, shadowy form darted out of the darkness, perched on a moss-covered bowlder, and turned a pair of bright, inquisitive eyes upon the strange monsters which had invaded its snug retreat. The white throat gleamed conspicuously among the deep green surroundings as the bird paused a moment to complete its inspection; then up went the short, barred tail, straight into the air, and a succession of low, scolding notes emanated from the feathered mite as it hopped about in angry excitement.

We found that the bird existed in numbers; once we had discovered a way of entering its stronghold, it was possible to make the desired studies. Thus our difficult search, covering so many hundreds of miles, came to a pleasant and successful close.

***Scytalopus*, the tiny, wary bird in search of which the South American Expedition of the American Museum traveled many hundreds of miles. *Scytalopus* was finally discovered on the cold, bleak *paramo* above Taff del Valle, Argentina. Drawn for the JOURNAL by Mr. Henry Thurston**

A YUCCA SANDAL MANY CENTURIES OLD

The clever skill and unfailing patience with which the ancient Pueblos wrung from barren nature the things necessary for their existence can be no better illustrated than by this yucca sandal. Leaves of the soap weed were split, trimmed, and plaited to form the tough sole, and cords of fiber from the same plant served as lashings to hold the sole in place. When the soles became worn by sharp stones and grinding sand, they were patched and mended, and often reënforced with a lining of husks. When one gazes upon the vast bulk of the Aztec ruin, and tries to imagine how many thousand pairs of these sandals were worn out by the feet of the workmen as they plied to and from the quarries, one's thought goes forth in tribute to the sturdy barbarians who dreamed, achieved, and went their way generations before Columbus first set foot on Western shores

Discoveries at the Aztec Ruin[1]

By EARL H. MORRIS

Illustrations from specimens in the American Museum

TO reconstruct the life and customs of a people from the products of its material achievements is one of the tasks confronting the student who undertakes the systematic exploration of a prehistoric village or city. Difficult, even hopeless, such a task might seem to one who views the crumbling mass of earth and stone to which the elements have reduced the ancient Pueblo community village at Aztec, New Mexico. But slowly from the wreck of dwellings, of ceremonial and burial chambers, the spade brings forth examples of aboriginal handiwork. These are veritable bits of mosaic which careful skill may rearrange to yield a vivid picture of this town before the vicissitudes of time dispersed its builders, and made their hearths the homes of prairie dogs and owls. Since "the picture" can not be drawn until after the work of several years, all that will be attempted at this time is a description of some of the specimens found during the summer of 1916, and the conditions under which they were discovered.

Pottery vessels are perhaps the most striking feature of the collection gained from a preliminary excavation of the Aztec ruin. Because of the absence of metal and the limited use to which basketry can be put, vessels of clay served these people in a multitude of needs. There are many shapes among the vessels found, each suited to a par-

Photograph by Earl H. Morris

The Pueblos often used abandoned portions of their dwellings as repositories for discarded material. This room on the second floor of the north wing of the Aztec ruin proved to be a treasure house for the archæologist. The deposit, which covered the floor to a considerable depth, was filled with sandals, cloth, matting, baskets, cords, and fiber, seeds, bones of animals, broken pottery, arrow points, turquoise, and beads. Throughout the centuries no moisture penetrated the refuse, so even the most perishable articles were perfectly preserved. In fact, some of the dried corn leaves were as green as if taken from a last-season's shock

[1] This article follows the article by Mr. N. C. Nelson in the February JOURNAL, describing the excavation of the Aztec ruin. The excavation and reparation will be continued by the American Museum of Natural History through a period of several years, and make the largest piece of work of the kind ever undertaken in the United States

ticular type of function. In bowls various foods were served, or clay or pigment mixed for pottery making, or even mortar carried to the masons building the pueblo. Flat-bottomed mugs and tall pitchers with globular bases and straight necks were used no doubt as drinking vessels. Water was carried from the river in graceful jars, some of them of a capacity of several gallons. The jars are fitted with handles or lugs, the smaller ones for suspension by means of a thong, the larger for transportation by the hands, or to

The hollow bones of birds were fashioned into needles, beads and whistles. Scrapes or paddles were made from the short heavy bones of deer and elk, the trochanters offering a convenient grip for the hand. The longer bones were sawed and split longitudinally with flakes of flint into slender sections. These sections were then reduced by rubbing upon pieces of sandstone to highly polished and keen-pointed daggers, awls, and punches (The numerals in ink represent the catalogue numbers put on them by the American Museum)

aid the women in placing them upon their heads, in which position they were carried, either full or empty.

There were evidently occasional attempts to mold the forms of men or animals in clay, due perhaps to the individual caprice of the potter, or to a desire to represent some deity. Examples are rare, however, only one having been taken from the Aztec ruin. This is a seated human figure which had been broken. The marks of a keen-edged flake of stone upon the severed neck show that it was intentionally decapitated.

The most beautiful variety of pottery shows a red ground ornamented with black on the interior of the vessel,

These long chisel-like blades, commonly called skinning knives, are the most beautiful stone implements found in the Aztec ruin. They are made from an extremely hard, fine-grained material varying in color from black to creamy gray. Usually they are shaped so that the dark mottling and banding of the stone form a pleasing ornamentation. Such objects are called *tcamahias* by the Hopi Indians today, and in certain ceremonies they place them upon their altars to symbolize the spirits of departed warriors. No stone of the kind from which they are made is known to occur within one hundred and fifty miles of Aztec

The yucca plant furnished needles. A long slender strip was split from a leaf, and the basal portion chewed or beaten until the fibers were separated, and all but a few broken off. Those remaining were twisted around the cotton thread, thus attaching it firmly to the needle. The sharp thorny point of the leaf was strong and keen enough to pierce ordinary cloth, but if skins or tough fabrics were to be joined, doubtless a bone awl was used to open a way for the needle

and with yellow or cream color on the outside. This red pottery is rare at Aztec. Some specimens are evidently local products, while others so closely resemble the pottery typical of other parts of the Southwest, that from the evidence they furnish, it may be possible to determine that the people of the Animas Valley carried on primitive commerce with contemporaneous villages hundreds of miles distant.

Most of the pottery is found with the dead. It was a peculiar custom of the Pueblos to bury certain individuals, probably the more important persons, beneath the floors of living rooms, or in rooms set aside for mortuary purposes. Only a few graves were found last summer, but it is to be expected that many, some of them very rich, will be encountered before the excavations are completed.

Cooking was done in rough pots whose soot-covered exteriors resemble coiled baskets. They were made by the coiling process of pottery manufacture, and the resulting ridges were not smoothed down upon the outside. The cooking vessels never bear painted decorations, but the other types usually are highly ornamented. Upon the gray or white groundwork, attained in most cases by the application of a light-colored slip over the darker paste of the vessel, designs were traced in black pigment, and fired in. Most of the patterns are geometrical, with only now and then an attempt at realistic representation.

The large cooking pots are found as they were left, sometimes sitting in the ashes of extinguished fires. It was a common practice, when they were cracked, or would no longer hold liquids, to sink them into the floors, where they were used as bins or storage jars. Flat stones were put over them

for covers, and often the place of their concealment was completely hidden by a layer of mud. Under such conditions they would be passed over by the workmen during our work of excavation, were it not for the hollow rumble they emit when the floor above them is struck by the pick or shovel.

The difficulty which may be attached to the recovery of specimens during the excavation, and the extreme caution that must be exercised to make sure that none are overlooked, are well illustrated by the circumstances under which was made one of the best finds of the season—that of a large red bowl. The bowl was broken and the fragments had become scattered over the floor of a second story room. As slow decay of the supporting timbers enabled the rain to wear holes through the floor, one by one many of the fragments fell into the room beneath, and were covered by an accumulation of rain-washed earth. As this lower room was being excavated, a workman caught the glint of the sun upon a bright red potsherd (the name by which a fragment of pottery is known to an archæologist) in a shovelful of dirt. A day and a half of sifting followed, with the result that over ninety per cent of the bowl was recovered. The fragments were scattered over an area eight by eleven feet, and from six inches to three feet in depth. To recover them, 176 cubic feet of earth—more than six wagon loads—were run through the sieve.

Sifting is slow and tedious at best, but when it has to be done within doors, it acquires the qualities of an ordeal. In a room where not a drop of moisture has penetrated for centuries, and no current of air can enter save through an aperture only large enough for a man to crawl through, each movement stirs up a reek of pungent dust. In a few minutes the atmosphere is so thick that a man can not be seen five feet distant. The workmen cough and choke behind masks of wet cloths and sponges, and every little while have to come into the open for a breath of clean air. The acrid quality of the dust, due to its dryness and the presence of finely divided ashes, gypsum, and filth, leaves the membranes of the nose and throat inflamed for several days.

To the uninitiated there is nothing particularly suggestive or interesting about a few cartloads of rubbish; but a back room on the north side of the ruin, containing such an accumulation of refuse, proved to be a veritable treasure house. About thirty years ago relic hunters tunneled into the ruin and opened some rooms whose ceilings are still intact. The protection of these ceilings is one of the most difficult problems connected with the preservation of the Aztec ruin, and it was decided to clear one of them, and to lay a heavy coating of cement upon it in order to ascertain if in this way the beams could be kept sufficiently dry to resist decay. Men were put to work to remove the thirty tons of earth and stone which had fallen upon the ceiling from the walls of the third and the upper part of the second story. The first workman to reach the floor raised a section of a beam which had fallen from above, and beneath it lay a yucca sandal. In a few moments it became evident that the floor was covered to a considerable depth with refuse, every shovelful of which contained something of importance. Sieves were brought, and for five days two men worked in a cloud of dust separating the coarser material from the sweepings and ashes. When the task was completed, there

were eleven wooden dry goods boxes filled with a surprising variety of objects, something over six hundred specimens in all. The air space in the room below, and the several feet of earth above, had kept the rubbish as dry as if hermetically sealed, so that even the most perishable objects were perfectly preserved.

Photograph by Earl H. Morris

When cooking pots were cracked or worn out, they were sunk into the adobe floors to serve as storage or hiding places for grain and valued articles. In the picture a portion of one of the floors may be seen in the corner above the mouth of the jar. There was no sign to indicate that anything was concealed beneath until the curiosity of a workman caused him to investigate the hollow rumble which a tap with his pick upon the hardened earth brought forth from the drumlike cavity within the pot

Grains of corn, together with cobs, tassels, and husks were fully intact; also beans and bean-pods, pine cones and branches, and pumpkin seeds and shells. These, together with bones of turkey, rabbit, deer, and antelope, show plainly upon what wild and cultivated foods the aborigines depended for sustenance.

Cotton fiber, yucca leaves, and rushes represent the raw materials for textile products. The cotton was twisted into yarn and woven into cloth of excellent strength and texture, some of it ornamented in red and brown. The needles with which this cloth was sewed were ingeniously devised. A long strip was split from a yucca leaf, and the basal portion macerated so that only a few strands of fiber remained. The thorn at the end of the leaf made an effective point for the needle, and the frayed fiber at the opposite end was twisted in and around the cotton thread.

Yucca leaves, whole or split, were plaited into sandals and mats, or the separated fiber was twisted into cord. Some of the cord is as fine as number sixty linen, and some is as large as quarter-inch rope. A soft and heavy cloth was made from yucca cord and feathers. The down was stripped from the ribs of the feathers and wrapped about the cords, which were then woven into jacket-like garments such as have been found upon the dead in various parts of the Southwest.

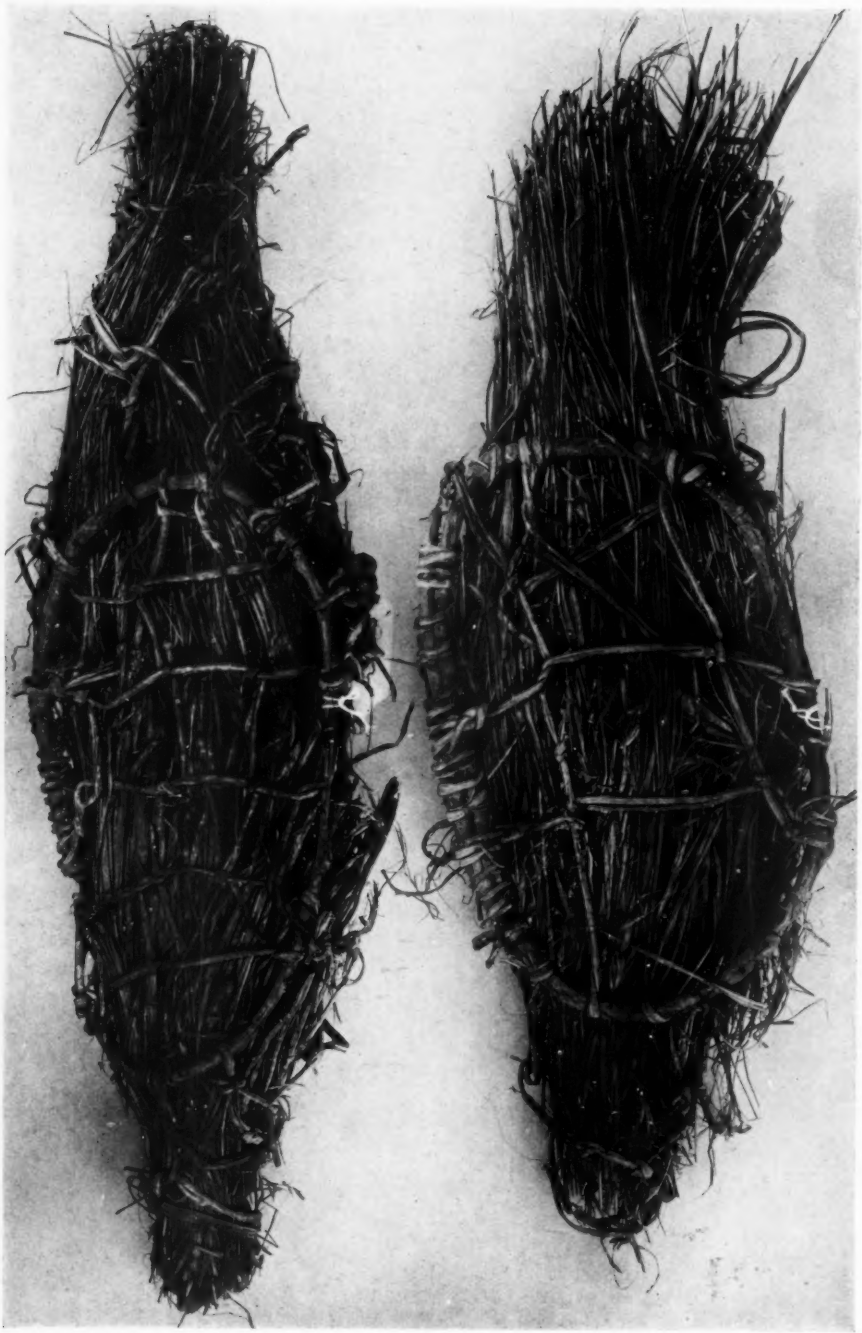
Rushes were plaited into mats for covering floors, or for wrapping the dead, also into sandals, baskets, and bags.

What appear to have been snow-shoes consist of an oval frame of willow laced across with yucca, and stuffed with husks and grass. They were found in pairs, some of them large, others evidently fashioned for the feet of children.

Numerous ornaments and perhaps ceremonial objects were mingled with the sweepings. There are disc-shaped beads of black, white, gray, and red stone, some of them only one sixteenth of an inch in diameter; a number of quartz crystals, one of them bound to a cotton cord with sinew; beaver tusks pierced and strung upon cords, and held in place by a backing of pitch; and more than three hundred sets of turquoise, shell, and coral-colored stone which had been inlaid in gum upon the surface of some object.

Although these descriptions are brief and fragmentary, they indicate the variety and richness of the material which may be expected to reward the continued excavation of the Aztec ruin. When the work has been finished, the features of the ruin itself and the wealth of specimens from it should make possible an accurate and comprehensive reconstruction of the material culture, as well as an instructive insight into the thoughts, beliefs, and customs of the people, evidences of whose handiwork caused the imaginative Spaniards to name the river which flows past their village Rio de las Animas Perditas—the River of Lost Souls.

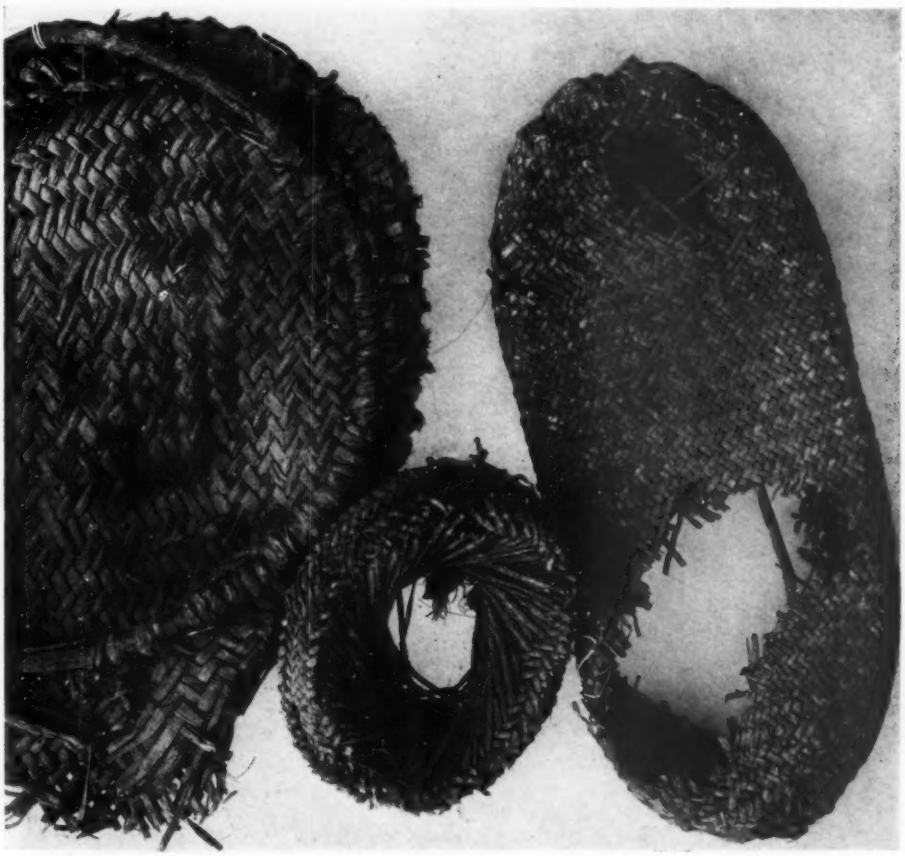
These corrugated cooking vessels are found, the larger ones sitting about where they were abandoned, sometimes in the ashes of extinguished fires; the smaller ones in the graves where they were placed to contain food for the dead. Why those who dwelt in the Aztec ruin should have used only vessels with rough exteriors for culinary purposes, is a question that is still unanswered



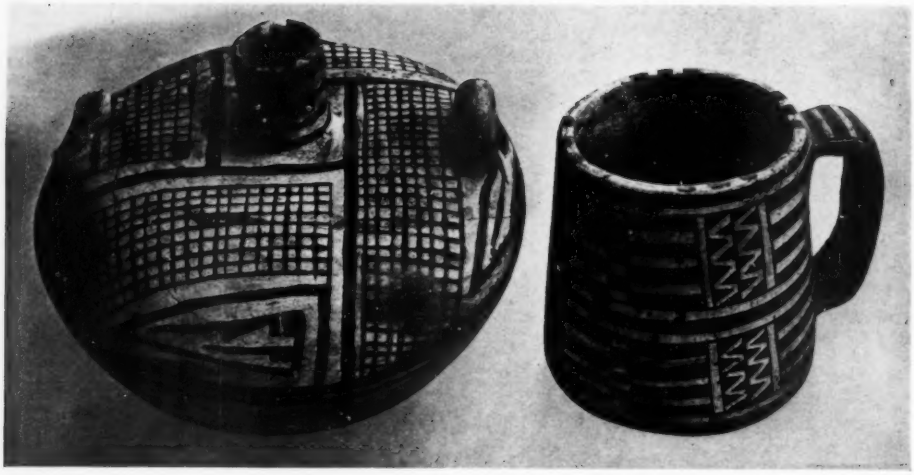
SNOWSHOES FROM AZTEC RUIN

Although winter storms seldom leave more than a few inches of snow upon the ground in the vicinity of Aztec, sandals were an inadequate protection against even so slight a fall. In consequence crude snowshoes were made from an oval loop of willow beneath which was lashed a bundle of grass or husks. When wearing these the traveler might go dry-shod and well protected from the stinging cold of the snow

The builders of the Aztec ruin used fiber of cotton and yucca for cloth making. The cotton garments intended to be worn during ritualistic ceremonies, and upon dress occasions, were as soft and pliable as heavy muslin. Ordinary apparel, sacks, and burden straps were woven from the coarser fiber of the yucca, or occasionally with warp of yucca and woof of cotton. The cotton plant was cultivated in the fields along the river, while the yucca grew—and still flourishes—on the rocky slopes and sandy wastes of the neighboring mesas



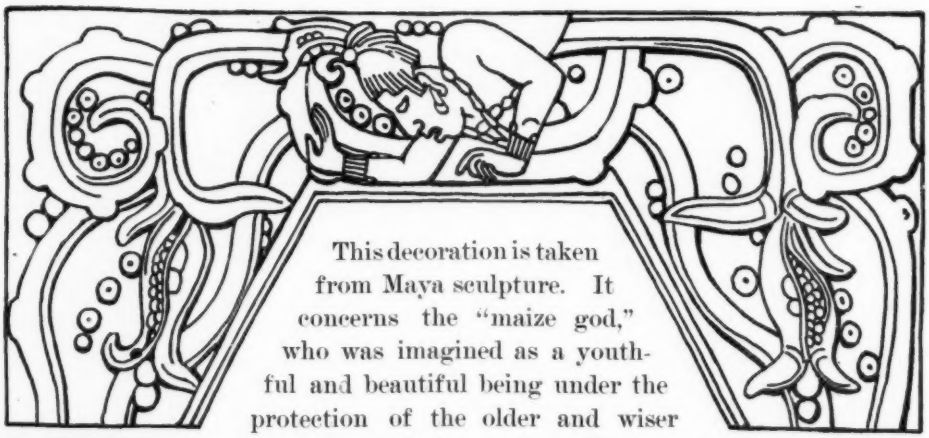
It is clear to what uses matting made of plaited rushes, baskets, and ring-shaped pot rests might be put, but there are some forms, like the cylindrical bag appearing at the right side of the picture, whose function baffles the imagination. A pillow, a cushion, a pad for the back when carrying burdens, are among the possibilities, but all are equally problematical and unsatisfactory



In pottery making Pueblo art found its highest expression. The gracefulness of contour, and the dignified simplicity of ornamentation to be observed in some of the specimens, make one realize that the search for beauty was as keenly alive in the hearts of prehistoric Southwestern peoples as it is in our own today

Due to the absence of metal, and the restricted use of basketry, pottery bowls were used for innumerable purposes. In them food was served, clay and pigment mixed for pottery making, earth borne away from excavations, and mortar carried to the masons. Refuse heaps are filled with fragments of them, and many excellent specimens are found with the dead

This large bowl is the finest pottery vessel found during the first season's excavations in the Aztec ruin. The ground-color of the interior is a dark red, upon which the graceful geometric pattern is traced in black pigment, while the dominant tone of the exterior is a light yellow, and the design is drawn in the same shade of red as was used to stain the background of the interior. This type of pottery is characteristic of another part of the Southwest, and from the presence of a few specimens at Aztec, we may safely conclude that the inhabitants of the Animas Valley traded with contemporaneous peoples hundreds of miles distant



This decoration is taken from Maya sculpture. It concerns the "maize god," who was imagined as a youthful and beautiful being under the protection of the older and wiser gods of rain and of sunshine. The upper detail is a stucco relief from the Palace at Palenque. The god comes down from above and at right and left are seen leaves and bursting ears of maize. The side details are from Stele H at Copan, where several maize gods clamber among feathers and twining serpents. The maize god always wears a headdress fashioned into a conventional ear of maize. Elsewhere in the New World also agriculture reacted strongly upon religion and art.

The world today is indebted to the work of the American Indian for the following :

Food Plants
- Maize
- Potatoes
- Sweet potatoes
- Tomatoes
- Pumpkins
- Squashes
- Lima beans
- Kidney beans
- Peppers
- Cacao
- Pineapples
- Strawberries
- Cassava
- Guava
- Peanuts
- Alligator pear

Medicines
- Tobacco
- Quinine
- Cascara sagrada
- Cocaine

Fibers
- Cotton
- Henequen

Gums
- Rubber
- Copal
- Peruvian balsam

Domestic Animals
- Alpaca
- Llama
- Guinea pig
- Muscovy duck
- Turkey

The Invention and Spread of Agriculture in America[1]

By HERBERT J. SPINDEN

ON the foreland of ancient American history the invention of agriculture is the one outstanding fact. For without a sure and abundant food supply, to be secured only by domesticating plants, the American Indians could never have risen above the status of hunters, herders, or lowly fishermen. Agriculture was indeed the indispensable invention that made possible all the higher arts, both in the Old World and the New.

Yet agriculture began independently in the two hemispheres. The plants found under domestication among the American Indians are distinct as a group from those known in Europe, Africa, Asia, and the Pacific islands, before the discovery of America. We have, then, in the New World and the Old two unrelated families of civilization, each dependent upon agriculture, but with unrelated groups of plants as the bases. In each area, the increase in population and the accumulation of wealth that resulted from this conquest of the vegetable kingdom made possible intellectual and artistic expression upon a grand scale.

The idea of agriculture may have had several points of origin in America, but this does not seem likely, since maize, beans, and squashes were common products wherever agriculture was practised. Other plants, fitted for special environments, had a more limited distribution, examples being the manioc of the humid lowlands of the Amazon basin and of the West Indies, and the common potato that was cultivated most extensively in the rather arid highlands of Peru. Wild stocks for some of the aboriginal food plants of America are often difficult to obtain, but botanical knowledge is far from complete for the more significant regions.

The cradle of New World agriculture appears to have been the high-

Pottery reproductions of maize, cast in molds that were made over actual ears of maize, have much scientific value. These reproductions were sometimes used as details on great ceremonial urns in southern Mexico

[1] The substance of this article was presented at the Second Pan-American Congress, Washington, D. C., December, 1916.

lands of Mexico and Central America. The nearest wild relative of maize so far discovered is a grass called in the Aztec tongue *teocentli* (sacred maize). When we consider the geographical and climatic range of maize, we must admit that the Mexican plateau is an intermediate and very likely home for the wild ancestor of this great food plant. On the north its cultivation had been extended in pre-Columbian times to the mouth of the St. Lawrence, and on the south to the mouth of the Rio de la Plata. It had been modified by careful breeding to meet extreme conditions of heat and cold, drought and moisture.

In restoring the early history of agriculture the most important source of information is archæological rather than botanical. There are manufactured objects, such as pottery vessels, associated with agriculture or dependent in a general way upon it, and some of these are practically indestructible; whereas plants and seeds survive only under the most exceptional conditions. Earthen bowls are both heavy and fragile and consequently of little use to wandering peoples. Stationary peoples alone develop pottery, and such peoples are usually on the agricultural plane of life. In America we find that the boundaries of pottery distribution closely parallel the boundaries of agriculture distribution, extending in some regions slightly beyond them. Pottery is made with an infinite variation in form and ornament and has almost the historical value of a written document. Like agriculture, pottery making was independently invented in the New World, along with loom weaving and other high arts, and probably spread outward from a single point of origin.

In the valley of Mexico pottery remains of sharply differing styles have been found in layers one above the other, and it is clear that the lowest layer is historically the earliest. The pottery of this lowest layer shows peculiar features in construction and ornament, and it has been possible to prove by these special features that ceramic art spread from Central America across northern South America to the mouth of the Amazon, and over the mountains of Colombia and Ecuador to the coast of Peru. All the higher civilizations in the New World seem to have risen from the general level of what has been called the "archaic horizon." The trail of pottery of the ancient type marks the first distribution of agriculture.

When we examine the exact distribution of this most ancient of all pottery, we find that it is abundant in open, arid country, and rare or wanting in humid, forested country. Theoretically, agriculture would be more likely to originate under conditions that were hard rather than under those that were easy. Necessity, they say, is the mother of invention.

Irrigation is often looked upon as a remarkable sequel to the introduction of agriculture into an arid country. But from the best historical evidence at our command, we should rather regard it as an invention which accounts for the very origin of agriculture itself. The earliest records of cultivated plants are found in Mesopotamia, Egypt, Mexico, and Peru, where irrigation was practised, and in each region are likewise found the earliest developments of the characteristic arts of sedentary peoples—namely, pottery and weaving, and the elaborate social and religious structures that result from a sure food supply and a reasonable amount of leisure.

Quite aside from these known facts

POTTERY REPRODUCTIONS OF SQUASHES

Peruvian collections give us many examples of molded and modeled squashes (see the first two specimens), showing the special breeds developed in that region. The very texture of the rind is minutely reproduced in some pieces.

Gourds, squashes, and pumpkins were cultivated by the ancient Mound Builders of the eastern United States (see third specimen). Representative art never attained to the skill that is exhibited in Peruvian pottery, nevertheless the intention is unmistakable

in the case, there are several reasons why we should expect to find the first appearance of agriculture in an arid environment. The press of population on food supply is greater there than in the free-and-easy lands where nature man culture, there is usually such a supply of wild game, of berries, and of edible roots, that the advantage of tilling the soil does not at first appear. Even when agriculture is known in such favorable country, the indigenous

The "maize god" of the Peruvians (see figure at the left) was buried in the field as a prayer for good crops, and in some sections the ceremony is still kept up. The body is formed of molded ears of maize.

The cemetery of Chimbote on the arid coast of Peru has furnished us this jar decorated with peanuts (water jar at right). The realism of these ancient casts made from molds is in contrast with the rather conventional treatment of modeled representations

is bountiful but where an insidious competition works behind the screen of plenty and cuts down life. In the desert the clearing of the field is less laborious than in the jungle, and the control of the life-giving water makes man the master of the entire situation. As for the intermediate type of environment, where agriculture is possible without irrigation, and where it normally spreads with the rise of hu- plants are seldom found under cultivation.[1]

It is perhaps an open question whether the extreme tendency to conserve energy, seen in most desert plants, has not increased their com-

[1] The abundant harvests of wild acorns in California, of wokas in southern Oregon, of wappato along the Columbia, of camas and kous in the pleasant uplands of Idaho, and of wild rice in the lake regions of Minnesota and southern Canada, were effectual barriers against the invention or spread of agriculture among the tribes inhabiting these regions.

parative food value over plants of more propitious climes. At any rate, seeds that grow with avidity on the slightest encouragement form a large part of the dietary of desert peoples. The screening and washing of these seeds at springs and beside streams would naturally result in volunteer crops and suggest artificial watering. Whether the release of these wild plants from a harsh life to one of continuous ease under irrigation would result in physical changes greatly increasing their food value is a question that botanists should answer. Certainly after the plant has been reduced to cultivation, the adaptation to new environments must be tremendously hastened by artificial selection. Only the plants that grow to maturity give seeds for the next planting, and these seeds are carefully preserved and planted in the most favorable situations.

Agriculture received special emphasis in Mexico and Peru. Maize, beans, and squashes are common to both areas, but with considerable local variation. Sweet potatoes, the *camote* of the Aztecs, are also cultivated in both Mexico and Peru, but are probably of humid lowland origin. In Mexico several varieties of red peppers, often called by the Aztec word *chile,* were cultivated, as well as the tomato called *tomatl* in the same language. The latter was used mostly in softening the rigors of chile sauce, and several varieties are described in early books. Cacao takes its mispronounced name from the Aztec word *cacauatl,* which referred to the dried nibs. When ground, this fruit seed was called *chocolatl* and was made into a delicious drink. Cacao was grown in the lower and more humid parts of Mexico and Central America, under the shade of another tree, called the "mother of cacao," and was an object of trade with the highland tribes. This plant does not seem to have been known to Peru, although the mountain tribes of western Venezuela cultivated it and made a drink called *chorate* from the seeds. Cacao was grown also in many parts of the lowlands of South America and in the West Indies.

In Peru the potato was especially developed. It is doubtful if this plant was known to the Mexicans, although it was commonly grown throughout the Andean region, and a wild form occurs as far north as Colorado. Peanuts also appear to be a Peruvian specialty.[1]

The weight of anthropological science is strongly against over-sea transmission as an easy explanation of enigmas in human culture, and it behooves us not to assume lightly that any cultivated plant was common to both the Old World and the New before the coming of Columbus, until the fact has been established beyond doubt. Domestic species of plants in cosmopolitan use in 1500 are rare, and possibly the only example is the common gourd, which appears to be one and the same in the Old World, in the islands of the Pacific, and in America. It is not a food plant, but was much cultivated for household and ceremonial uses. An important economic plant, that does not appear as a single species but rather as a world-encircling family of closely related species, is cotton. Many

[1] There was also a sort of fruit called by the Aztecs *tlalcacauatl* (earth cacao), which is said to have been roasted before eating. This fruit may possibly be identified with the peanut, since the modern Mexican word for peanut is *cacahuate*. In South America the Peruvian word *mani* is used. Several wild species of peanuts are said to occur in South America. Other Peruvian and Colombian products are the roots of the *oca*, and the arracacha. Great use was also made in Peru of the seeds of quinoa, a plant of the pigweed family, and in Mexico small seeds of similar type were used.

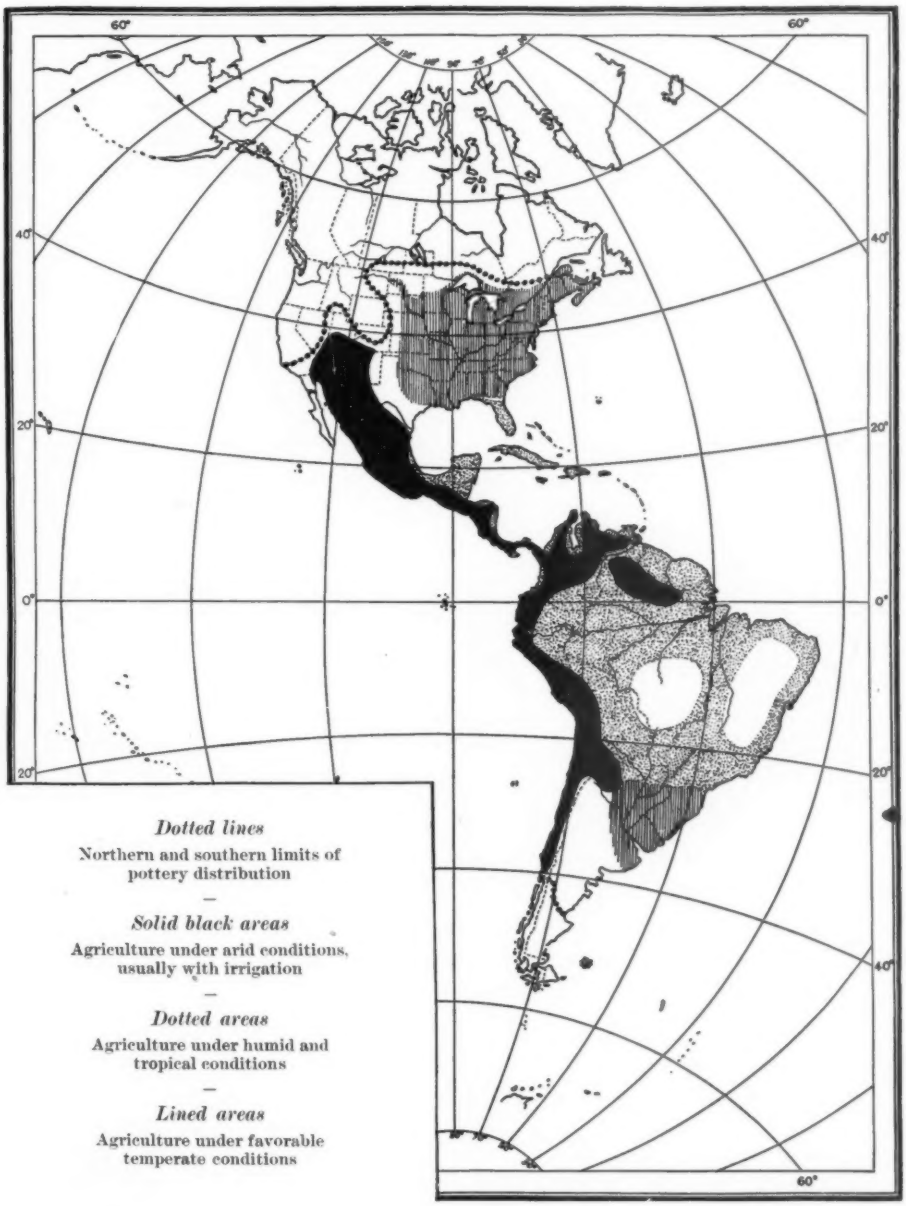
wild species have never been brought under cultivation or turned to human use. Cotton also occurs on oceanic islands, such as the Galapagos, which were entirely uninhabited until modern times. But it is important to note that the modern cotton of commerce is essentially that of the American Indians.

Both the gourd and the cotton are enabled by nature to take the widest advantage of distribution by wind and water, and we may be permitted to assume that they passed in such fashion from the Old World to the New. The coconut, which was doubtless known in the Old World before the discovery of America, may have been distributed by ocean currents. Nearly all the related palms are indigenous to tropical America, but there is no certain evidence that the coconut itself actually existed under cultivation, or even in a wild state, in pre-Columbian America. No remains of the fruit and no pictures of the tree are found in archæological collections, and native names for the coconut are conspicuously absent among Indian tribes.

The earliest references to maize in China are considerably subsequent to the discovery and conquest of America, and while the evidence points to Tibet as the region from which maize entered China, we must remember that the caravan trade between the Near and the Far East was at its height in 1500. Moreover, the world empire of Spain embraced large sections of the East Indies as well as of the West Indies and the mainland of America. It was an age that throbbed with energy, when new ideas were eagerly seized upon. The exchange of occidental and oriental food plants is seen not only in the introduction of maize and sweet potatoes into China, but also in the introduction of the banana and sugar-cane into America.

The map given herewith shows the limits of pottery distribution and, within these limits, the areas known to have been given over to agriculture. A rough distinction is made between three general types of agriculture. The first, and apparently oldest, type occurs in open and rather arid territory of considerable elevation, where irrigation is usually necessary. The second type is found in the humid, tropical lowlands where the land must ordinarily be cleared of the forest before planting can be done. The third type occurs under temperate conditions in partly open and partly forested country where irrigation is not required. The arid highland area extends from southern Colorado and Utah to southern Chile. An outlying area is also drawn across the Guiana highlands, but this is somewhat doubtful and proof of its existence must await future exploration. As we have already seen, agriculture seems to have spread over most of this open country on the first wave.

The second type of agriculture is that developed to meet the conditions of the humid and heavily forested tropics. The Maya civilization, probably the most brilliant of the New World, was made possible by the agricultural conquest of the rich lowlands of Central America. On the highlands the preparation of the soil is comparatively easy, owing to scanty vegetation and a control vested in irrigation. On the lowlands, however, great trees have to be felled and fast-growing bushes kept down by untiring energy. But when nature is truly tamed, she returns recompense manifold to the daring farmers. Moreover, there is reason to believe that the removal of the for-



POTTERY DISTRIBUTION AND AGRICULTURE IN THE NEW WORLD

The most reliable information regarding the agriculture of the past lies in the pottery (fortunately indestructible through the centuries) which was inseparably associated with it. The oldest type of agriculture (black on the map) appears to have arisen in arid country of high altitude, where irrigation was necessary, extending finally from southern Colorado and Utah to southern Chile.

The second type (dotted on the map) developed in humid and heavily forested tropical lowlands, where the land had to be cleared before planting. The brilliant Maya civilization was founded on an agricultural conquest of the rich lowlands of Central America.

The third type developed in temperate country, partly open and partly forested, and was best represented in the eastern part of the United States. Maize, beans, and squashes were common products of all three types of agriculture

est-cover over large areas affects favorably the conditions of human life, which under a canopy of leaves are hard indeed.

But while extremely high civilization might result when the material wealth of the humid tropics is garnered by a closely organized people, the general run of more or less haphazard agriculture in the tropics leads to no such state of affairs. In the great Amazon Valley, and in the flanking valleys of the Orinoco and the Plata, we find agriculture unaccompanied by high social developments, although weaving and pottery-making are everywhere practised. Maize, beans, and squashes are known throughout this area, but maize is displaced from the position of first importance by manioc. Two species of this plant are used, one having a poisonous juice, the other being harmless. Both plants, along with many other species of the same family, are said to grow wild in Brazil, and there is little doubt that domestication first took place in this area. A single technical process of extracting the poisonous juice of the favorite manioc is found wherever the plant is cultivated, and similar types of clay griddles are used in making the cassava cakes.[1]

The third type of agriculture was adapted to temperate conditions. It is most completely exemplified in the eastern half of the United States, but seems also to have been developed, although to a much less extent, in parts of the Argentine and Uruguayan pampas. Maize is again the staple, with beans and squashes as associated crops. Among the Mandan Indians of North Dakota maize was modified to meet the conditions of a very short summer and to ripen within sixty or seventy days after planting. Among the Iroquois agriculture was also brought to a high plane, especially when we consider that all the plants under cultivation were indigenous to the tropics.

If we glance at the crop report of the United States, we find that the annual value for this country alone of plants brought under cultivation by the Indians amounts to three thousand millions of dollars—and the debt of the world is only partly acknowledged. Maize is our principal farm crop, and in its production we lead the world, but in certain other products of the American Indians, such as beans and potatoes, the production of the United States is but a very small part of the world's production. If we remember that in the four hundred years that the white man has dominated the New World he has not reduced to cultivation from wild stock a single important staple, the wonder of the American Indian agriculture becomes still greater.

1 If we should extend our study of agriculture to semi-cultivated trees, the list of valuable products would be greatly increased. Mention may be made of the favorite alligator pear, whose current name is a gross mispronunciation of *aguacate*, of several members of the anona or custard-apple family, including the soursop or guanabena, the chirimoya or sweetsop, and the custard apple, of the granadilla which is the fruit of the passion flower, of the lucuma and its relative the marmalade plum, of the star apple, of the sapote or nispero, of the mamey apple, of the nance or Barbados cherry, of the guava, of the ciruela or jocote, and even with these names the list is far from complete.

Nor can we take time to more than mention some of the other important economic plants cultivated by the Indians. Of these the first in value is the modern cotton of commerce. The cultivated cotton of the American Indians has virtually displaced the Old-World types. Many other fiber plants were also brought under cultivation such as henequen. Tobacco was widely domesticated from several species both in temperate and tropical America. Important medicines derived from the Indians are cascara sagrada, cocaine, and quinine.

On the Greater Use of Indian Foods

THE war that is upon us will sooner or later compel us to conserve to the last degree our economic strength by the elimination of actual waste in food and by the higher and more scientific use of the materials at hand. Food habits are notoriously fixed, but great events sweep away prejudices. We have inherited most of our food habits from the Old World and we call wheat bread "the staff of life," even though the same nourishment can easily be secured in other foods. Now maize is the great aboriginal food of America and its possibilities have been imperfectly realized by ourselves. This grain is just as much a favorite staple among our neighbors in Central America as is rice among the peoples of southern Asia or wheat in western Europe.

Certain dishes of the American Indians were adopted by the early colonists in New England and elsewhere. Thus samp was instantly appreciated by the hungry English and described by Roger Williams in 1643 as "Indian corn beaten and boiled and eaten hot or cold with milk or butter." At a still earlier date, 1630, Captain John Smith mentions hominy, a name ordinarily applied to maize that has been boiled with alkali. The alkali (lime, potash, snails' shells, etc.) causes the outer skin of the grain to peel away, leaving the white inner portion soft and palatable. This method of preparing maize was widespread over North and Central America. Succotash is a Narraganset word that has been misapplied to a mixture of corn and beans; it originally meant simply an ear of maize. Hoe cake was taken over from the southern Indians. A favorite food of the early explorers and trappers was parched corn meal, which combines great nourishing power with slight weight. This was much used by the Iroquois warriors in their long raids against other tribes, when each man had to carry his own food.

But the Indian tribes of our Southwest and of Mexico and Central America are more civilized than those from whom these foods have been adopted, and their culinary efforts are more worthy of imitation. A greater use is made by them of maize flour in contradistinction to rough meal. The "paper bread" of the Pueblo Indians is gruel baked on stone stoves. The top of the stove is smoothed by an addition of clay and oiled with pumpkin seeds. This "paper bread" may be of several colors, according to the different kinds of maize, and it has excellent keeping qualities. In Mexico the same method is employed for *totopoztli,* which is, however, baked until brown and crisp.

Hulled corn or hominy, ground into a paste, furnishes dough for the *tortillas* or unleavened cakes that take the place of bread in Mexico. Although the ordinary *tortilla* is rather soggy, when made thin it is delicious. For a breakfast dish nothing can surpass the *enchilada,* which is a *tortilla* rolled up cigar-fashion with a little meat, cheese, or chili pepper as a surprise in the center. This is toasted before the fire until it is crisp and crackling. *Pinole* is, properly speaking, a parched meal made from maize and other seeds. The word is applied to a variety of dishes, such as stews of maize, meat, and chili peppers. *Pinolatl* (*pinole* water) and *posole* are refreshing drinks made by stirring maize paste or dough into sweetened water. The *tamale* is perhaps the best known dish of the Mexican Indians, at least as far as the word is concerned. It is made in many different fashions.

HERBERT J. SPINDEN.

ONLY HIEROGLYPHIC
INSCRIPTION FOUND AT TULOOM

Monument three feet wide, eight inches thick, found by Stephens in 1842. Both faces are sculptured with human figures, the one shown above carrying the two-headed ceremonial bar, the most common emblem of authority in Maya sculpture. The inscriptions on both surfaces are presented in two vertical panels and in a horizontal panel across the top. The date recorded (at the left) is 9.6.10.0.0 8 Ahau 13 Pax of Maya chronology, approximately 290 A.D. See page 201

The Ruins of Tuloom, Yucatan

THE RECORD OF A VISIT OF THE CARNEGIE INSTITUTION CENTRAL AMERICAN EXPEDITION, 1916, TO AN IMPORTANT BUT LITTLE KNOWN ANCIENT MAYA CITY. TULOOM HAS BEEN INACCESSIBLE SINCE 1848 BECAUSE OF INDIAN HOSTILITY

By SYLVANUS GRISWOLD MORLEY

Illustrations from photographs and drawings by the Expedition

THE ruins of Tuloom[1] on the eastern coast of the peninsula of Yucatan have long held a peculiar interest, not to say allurement, for the student of Maya archæology. Perhaps no other city of this great native American civilization, which flourished during the first fifteen centuries of the Christian era in Middle America, has been invested with greater mystery, and has at the same time been less known. Only thrice since its discovery in 1842 has this inaccessible spot been visited by scientific parties, and only once—namely, last year—has an expedition succeeded in establishing itself there for more than twenty-four hours.

The first European notice of Tuloom seems to be that in the itinerary of the voyage of Juan de Grijalva to the coast of Yucatan, in 1518, written by the chaplain of the expedition, Padre Juan Diaz. In this itinerary, which naïvely refers to the "Island of Yucatan," mention is made of a large city on the east coast, which can hardly have been other than Tuloom: "We ran along the coast a day and a night, and the next day toward sunset, we perceived a city or town so large that Seville would not have appeared more considerable or better. A very large tower [probably the Castillo] was seen there, and on the bank there was a crowd of Indians, who carried two standards which they raised and lowered to signal us to land, but the commander did not wish it."[2]

The first modern notice of the site was that of the American traveler Stephens in 1842, which, as far as general knowledge was concerned, had all the value of actual discovery. This intrepid explorer with his *fidus Achates,* the English artist Catherwood, visited Tuloom, coming thither in a small open boat from the island of Cozumel.

The results of his visit were given to the world in his highly entertaining *Incidents of Travel in Yucatan,*[3] which (together with the companion volume *Incidents of Travel in Central America, Chiapas and Yucatan*) yet remains, after the lapse of more than three-quarters of a century, the classic on this region.

He published a map of the site, together with Catherwood's splendid drawings of the principal buildings.

1 The spelling "Tuluum" is to be preferred on etymological grounds, but "Tuloom" is the generally accepted spelling. Luum in Maya means "land" or "earth"; and tu, "in" or "to" with the possessive pronoun of the third person. Tuluum may mean "In his or its land," a not inappropriate name for a coast city.

2 *Recueil de Pièces Relatives à la Conquête du Mexique.* Voyages, Relations et Mémoires originaux pour servir à l'histoire de la découverte de l'Amérique. Vol. X, p. 11. H. Ternaux Compans.

3 John Lloyd Stephens, *Incidents of Travel in Yucatan.* Harper & Brothers, New York, 1843. Chapters XXI and XXII.

His description is close, and, as far as it goes, conveys an adequate impression of what he saw, and it must be admitted he missed but very little. He was the first to describe the hieroglyphic monument (Stele 1) found broken into fragments on the floor of Temple 7, to secure photographs and drawings of which was the especial object of the Carnegie Institution Expedition to Tuloom last winter.

In 1848, a few years after Stephens' visit, the so-called "War of the Castes" devastated Yucatan. The Maya Indians, goaded to desperation by three centuries of abuse and misrule, rose against the *hacendados,* or planters, and drove them from the plantations and villages throughout the country into Mérida, the capital of the state.

After the planters had succeeded in quelling this sanguinary revolt, many of the Maya fled eastward into the uninhabited parts of the peninsula along the east coast, and settled in the region around Tuloom, whither the whites dared not follow them. Here they have maintained themselves in virtual independence ever since. Even under the iron rule of Diaz, this section of Mexico, the territory of Quintana Roo, was never brought under effectual control by the federal government, and the Mexican garrison maintained at the territorial capital, Santa Cruz de Bravo, was practically in a state of siege. Only large bodies of troops could move through the bush with safety, stragglers being slaughtered without mercy. For this reason the ruins of Tuloom have been closed to investigation for the past seventy years, and to this same reason also is doubtless due the atmosphere of mystery and romance which has grown up around the site.

The Field Columbian Expedition of 1895 was deterred from visiting the site, although Mr. William H. Holmes secured several drawings of the principal temple, from the yacht "Ituna," which was put in close to shore for this purpose.[1] Indeed, as recently as 1914, the local Mexican authorities at Santa Cruz de Bravo prevented members of the Peabody Museum Central American Expedition for that year from visiting the site, giving as their reason the hostile character of the Indians.

The first scientific expedition to visit Tuloom since Stephens' time was that under Dr. George Howe, of the Peabody Museum, in 1911. Dr. Howe and his companion, Mr. William D. Parmelee, made the journey from Progreso, the port of northern Yucatan, to the island of Cozumel, on a Mexican gunboat, and thence by a sailing vessel of small tonnage to Tuloom. He was at the ruins only parts of two days, and then, having seen supposed Indian signals—a fire on shore at night, and during the day a white flag waved inland in the direction where the Indian village was supposed to lie—his party became convinced that an attack by the Indians was imminent, and made immediate preparations for departure. These hostile demonstrations largely prevented Dr. Howe from carrying out an extended study, and with the exception of a few rather inadequate photographs and such hasty observations as he was able to make in the limited time he was there, little was accomplished in furthering the general knowledge of the site.

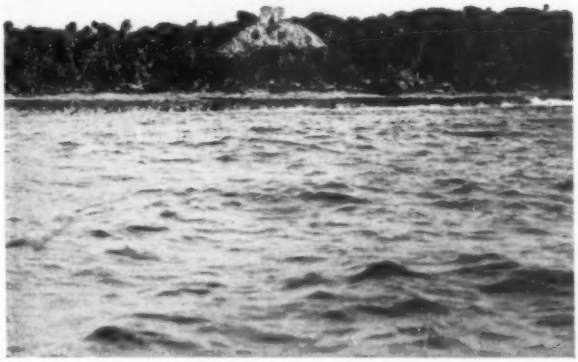
Dr. Howe's most valuable contribution was the reading of the date on the

1 William Henry Holmes, *Archæological Studies Among the Ancient Cities of Mexico,* Field Columbian Museum, Publication 8, Anthropological Series, Vol. I. pp. 75–78, figs. 23 and 24.

hieroglyphic monument discovered by Stephens in Temple 7. This he deciphered as "9.6.10.0.0 8 Ahau 13 Pax," of the Maya chronological era, which in the writer's correlation of Maya and Christian chronology corresponds to 290 A.D. Unfortunately his photographs of this important monument were very indistinct, and his reading for this reason remained open to considerable doubt. The results of his visit to Tuloom were published in the *American Anthropologist* for December, 1911.[1]

In 1913 the writer and Mr. J. L. Nusbaum paid a very brief visit (five hours) to the ruins in behalf of the School of American Archæology. The journey was made in the same way as that of Dr. Howe two years earlier, and its results were even more unsatisfactory. The dory in which the writer's party landed was capsized in the heavy surf which always pounds the Tuloom beach, and all but five of the photographic plates were ruined. Happily, however, every one of these resulted in a brilliant, clear negative.

A more serious matter was the failure to locate the hieroglyphic monument first reported by Stephens and later by Howe, which had been the primary object of the visit. Not until many months later, after he had returned to the United States, did he learn that



The east coast of Yucatan from Tuloom to Cape Catoche is dotted with ruins of small temples. Some of these doubtless correspond with "the three large villages distant some two miles one from the other," consisting of "a great number of stone houses, some towers very high, and many houses covered with thatch," mentioned by the chronicler of the Grijalva expedition of 1518

Off the coast at Tuloom a reef, about a quarter of a mile out, extends for a long distance north and south. Over this in rough weather booms the sea, making itself heard for some distance inland. Within the reef the water is comparatively calm, and here the "Corozal" lay at anchor with her fires out while the expedition was exploring the ruin

[1] The Ruins of Tuloom. *American Anthropologist*, N. S., Vol. XIII, No. 4, Oct.–Dec., 1911, pp. 539–550.

Dr. Howe had removed this monument to the beach north of the principal temple.[1]

The past field season (1916) seemed especially favorable for visiting this little-known but highly interesting center of aboriginal population, a combination of unusual factors making the moment peculiarly opportune for the attempt. To begin with, for the first time in many years, the Mexican government had reached a friendly understanding with the Santa Cruz Indians; the capital of Quintana Roo had been transferred from Santa Cruz de Bravo in the interior to Payo Obispo on the shores of Chetumal Bay, and the old capital with all its improvements had been turned over to the Indians, thus settling an old controversy. Again, the writer was at Belize, much the best point of departure for visiting Tuloom, with an unusually complete field equipment; and finally, the staff of the expedition was sufficiently large, including five investigators and assistants, to insure a fairly adequate preliminary study of the site in a minimum of time —the latter not an inconsiderable factor in spite of the recent "peace negotiations." The dry season was at its height; in short, all factors com-

The rugged outline of the bluff at Tuloom and the surging surf at the base. Above rises the Castillo, the "very great tower" of Padre Diaz' early sixteenth century description, pricked out in striking silhouette against the sky. All modern nautical charts give this tower as a prominent landmark, visible for many miles

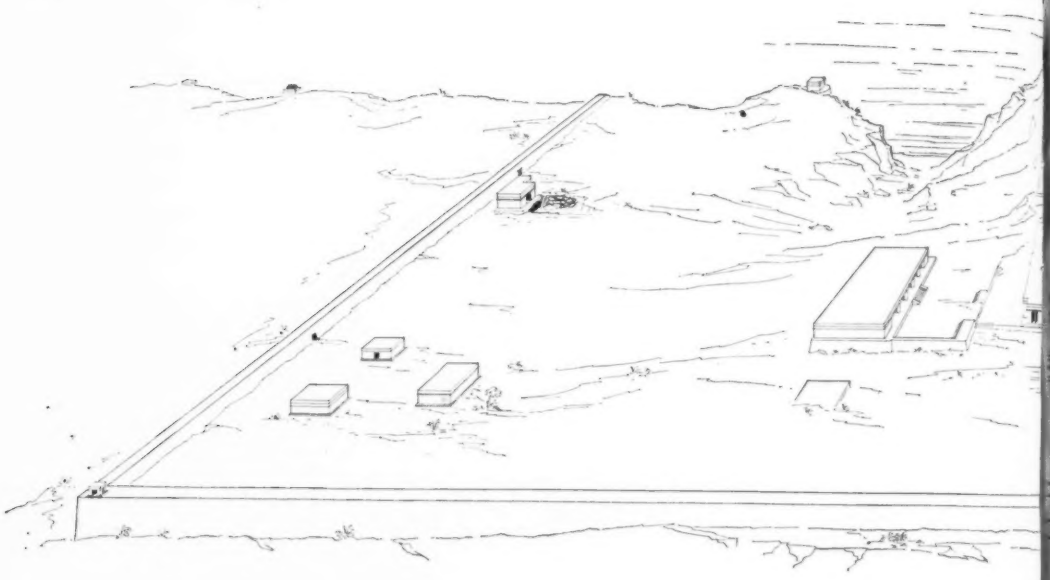
1 Since the foregoing was written a letter from Mr. Lothrop, at Belize, British Honduras, states that the Tuloom stele has probably been lost. A small sailing vessel from Cozumel, commissioned to bring out the monument, has apparently gone down in a great storm that swept the coast of Yucatan.

bined to make the moment ripe for the attempt.

A small steamboat, the "Corozal," of about forty tons, was chartered in Belize with a crew of ten, and these with the expedition staff and servants made a total of seventeen on board. The "Corozal," in palmier days, several decades earlier, had been a tugboat in the United States. Having outlived her usefulness, or perhaps better her "safefulness," in this country—it was understood she had been condemned here—she had been sent to Belize for use in the coastwise shipping trade. Her pilot assured the writer that, "Thirty years ago when she had a gold h'eagle h'up for'ards she were a good boat!" The staff of the expedition consisted of the writer; Mr. A. W. Carpenter, the photographer; Dr. G. Underhill, the physician; and two collaborators, Dr. T. Gann, Chief Medical Officer of British Honduras, and Mr. S. K. Lothrop, of Harvard University.

The expedition sailed from Belize on March 19 and two days later anchored inside the reef off Tuloom. The trip had been uneventful except for the complete and scientific demonstration that the "Corozal" could not under any circumstances do the nine knots an hour her owner generously and optimistically accredited her. The truth was that by crowding her boilers beyond a reasonable margin of safety and with the current in her favor, she managed to limp along at six.

The breakers run high at Tuloom. The beach slopes gently so that our dory was brought within a hundred feet of the land. Here the boys took the baggage of the expedition on their shoulders and waded ashore



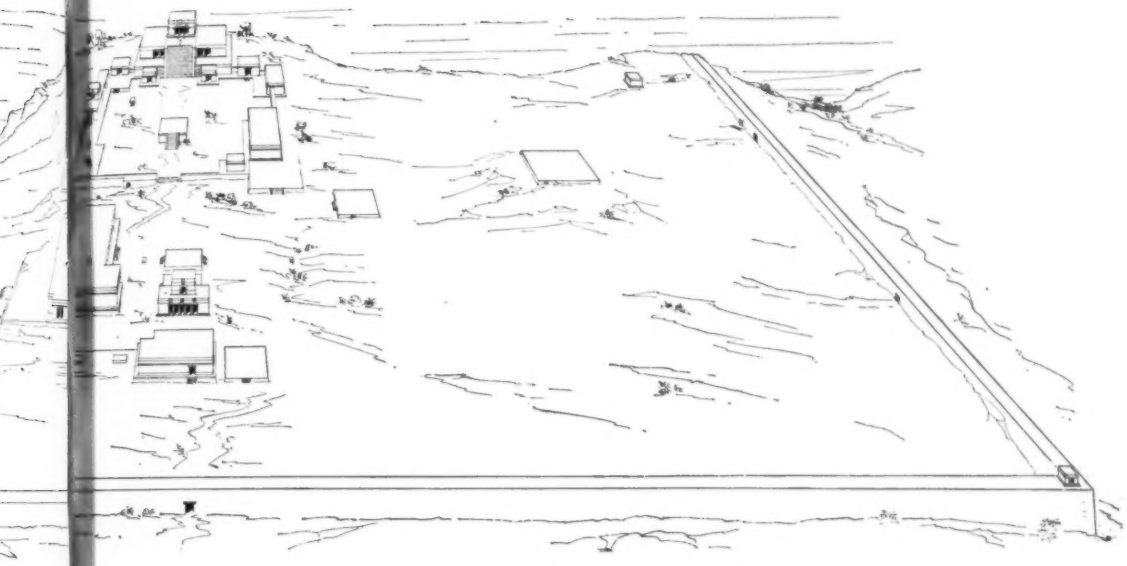
Panorama of Tuloom, looking eastward toward the sea.—The city as it might have appeared some five hundred years ago, if viewed from an aëroplane. Such a view today, however, would show only the unbroken top of the dense tropical forest in which the crumbling buildings now lie buried. The enclosure comprises about twenty-two acres, wherein are scattered a score of temples. The chief sanctuary, at once the religious and architectural center of the city, dominates the entire space, other buildings being grouped to accentuate further its importance

The ruins of Tuloom are located on a bluff overlooking the Caribbean Sea. The principal buildings—probably the civic and religious center of the city—are surrounded by a wall. The wall forms three sides of the enclosure, the fourth side being the precipitous and in many places unscalable bluff fronting on the sea. The area within the walls is fifteen hundred feet long (north and south), and six hundred and fifty feet wide (east and west). It comprises about twenty-two acres, and is now completely overgrown with a dense tropical bush, which hides one building from another.

The wall is an interesting and almost unique feature, there being but one or two others known in all Maya cities.[1] It is rudely constructed of unsquared stones, and is of varying thickness and height owing to the rolling nature of the ground. The top is generally level, and sufficiently wide, in places, for four men to walk abreast. The average height is from ten to fifteen feet. The three sides are pierced by narrow passages, the one toward the eastern end of the north wall having an offset in it, which must greatly have facilitated its defense.

The two corners are surmounted by small towers twelve feet square, each containing a single room entered by three doorways. Against the back in each is a small altar. This wall, the most extensive construction at Tuloom, has given rise to much speculation. What was its function? Was it built for defense or to enclose a sacred precinct? Both explanations have something in their favor, but a combination of the two probably more nearly explains its function. While built proba-

1 Mayapan in northern Yucatan was a walled city. Possibly Tenampua, Honduras, and Santa Cruz Quiche, Guatemala, may have had defensive walls, although nothing so extensive as those at Tuloom and Mayapan.



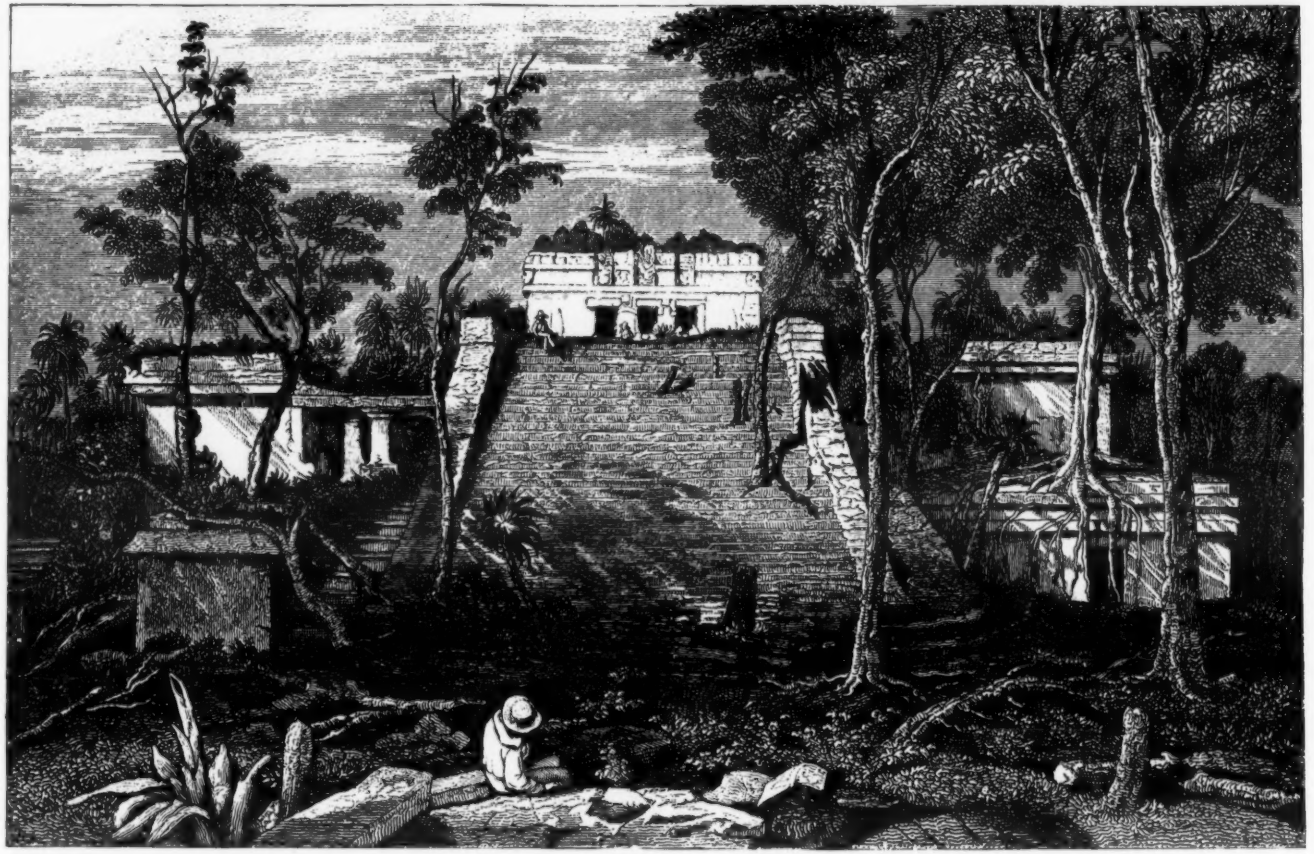
At the height of the glory of Tuloom, the glistening white buildings with their barbaric mural paintings, standing out clearly against the dark green forests of the seaward slope, the crowds of gaily dressed natives thronging the shore, and the brilliant blue of the Caribbean Sea stretching between, so impressed Padre Diaz, the priestly chronicler of the Grijalva expedition, that he was moved to write that his beloved "Seville would not have appeared more considerable or better." *Panoramic sketch by Mr. S. K. Lothrop*

bly primarily to enclose the temple area, its admirable defensive possibilities can hardly have been overlooked, and would appear to have been intensified by the use of narrow offset passageways and watchtowers.

Within the walls are scattered a score or more of buildings, and there are perhaps half as many, although smaller, hidden in the bush outside. The ground rises gently from the southwest corner of the enclosure to the top of the bluff along the sea. The principal temple, the so-called "Castillo," surmounts this crest facing toward the enclosure, that is, away from the sea. This is an elaborate construction on three different levels, the two-room building on top, probably the chief sanctuary of the city, being approached by a broad steep stairway. The flanking structures on either side are symmetrically arranged with reference to the central part, and present a number of interesting features, such as columns, wooden lintels, stucco figures, faces, animals, and mural paintings.

The architecture of Tuloom is distinctly of a late and debased period. Stylistically considered, the greater part of the structures now standing probably dates from after 1200 A.D. when the Maya had all but lost their ancient cunning. The building blocks are not even squared or faced,[1] as the walls were finished with a hard plaster coat. While the latter is doubtless true of other great Maya cities both of the Old and New Empires, that is, of the south and north respectively, elsewhere the building blocks are both squared and faced. The Tuloom masons, on the other hand, were slovenly and depended upon the plaster finish to cover up the more glaring faults of their

1 Mr. Lothrop noted a possible exception in the walls of Temple 30, where the blocks appear to have been both squared and dressed.



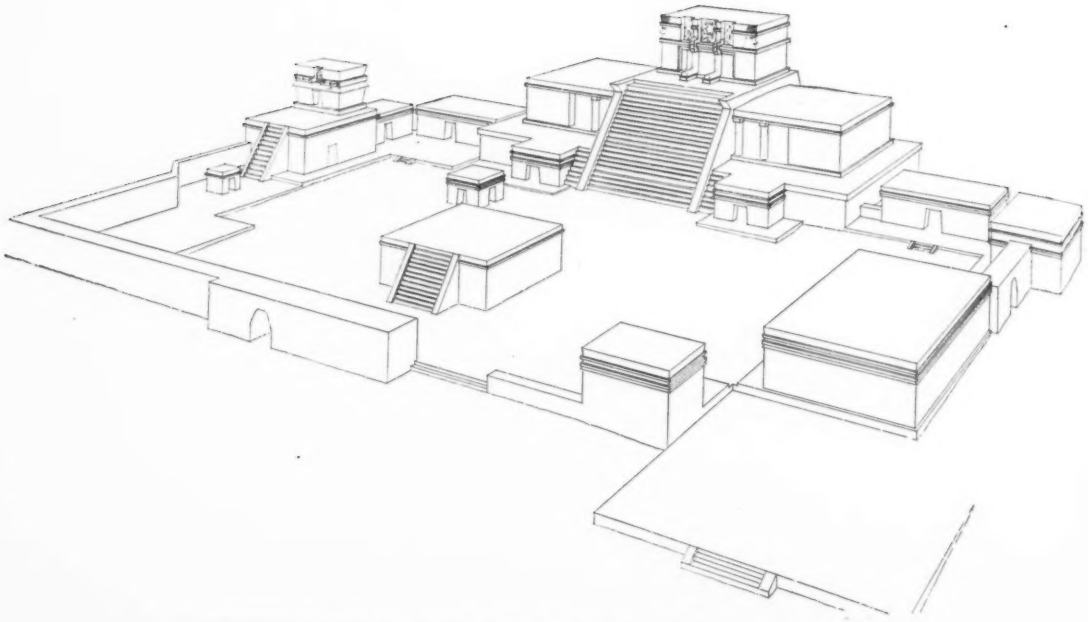
THE CASTILLO IN 1842

"The steps, the platform . . . and the whole area in front were overgrown with trees . . . which, with their deep green foliage and the mysterious buildings around, presented an image of a grove sacred to Druidical worship. . . . A few of the trees . . . appear in the engraving, and one is left growing . . . with its gnarled roots binding the front wall and obstructing the doorway, but no words and no drawing could convey a true idea of the solemnity of its living shroud, or of the impression made upon us when the ring of the axe first broke the stillness." From Stephens, *Incidents of Travel in Yucatan*

THE CASTILLO IN 1916

The chief agent responsible for the destruction of the ancient Maya cities is not the hand of man, disastrous as that has been, but the mighty strength of an irresistible vegetation. Large trees, striking their powerful roots deep into the foundations of temple or palace, literally rend it stone from stone, the masonry collapses, and disintegration follows.

This photograph shows the extent of the destruction wrought in the past seventy-five years. The cornice of the main temple, the balustrades and stairway appear to have lost a few stones, but otherwise the Castillo looks much as it did in Stephens' time



Drawing to show partial restoration of the principal temple group at Tuloom

This near view of the Castillo shows the feathered serpent columns, a late development of Maya art, portraying the rattlesnake, and probably introduced from the Mexican plateau sometime after 1200 A.D. The big block at the base is the head, the column itself is the plumed body, and the capital with its upward extension, the rattles. This type of column reached its highest development at Chichenitza, some sixty miles to the west of Tuloom

stonecutting, all of which was done with stone tools.

All walls, both exterior and interior, were originally treated with painted decorations. In some places, particularly on interior walls, these paintings have been partially preserved. The subjects depicted are the different deities of the Maya pantheon in acts of sacrifice. The famous red hand found by Stephens at so many places in Yucatan frequently occurs here. Dr. Gann made a number of tracings of these wall paintings, although in the limited time available it was possible to undertake little more than a beginning upon this important work.[1] Stucco was extensively employed in façade decoration. Discs, rosettes, and scrolls adorn the medial cornices and sometimes serpent or grotesque heads are used in the upper zones. The most elaborate development of stucco work is the large human figures in the niches over the exterior doorways. These stand three feet high, and probably represent the principal Maya deities. About half of them are in a diving position, that is, the feet are elevated above the head, with the arms together under the chin.

Human figures in stucco adorn the niches over the doorways of the principal temples at Tuloom. Some are erect, others are in a diving posture. They probably represent the principal deities worshiped at the place

Several buildings show different periods of construction, and careful study would doubtless develop different periods of building activity throughout the city.

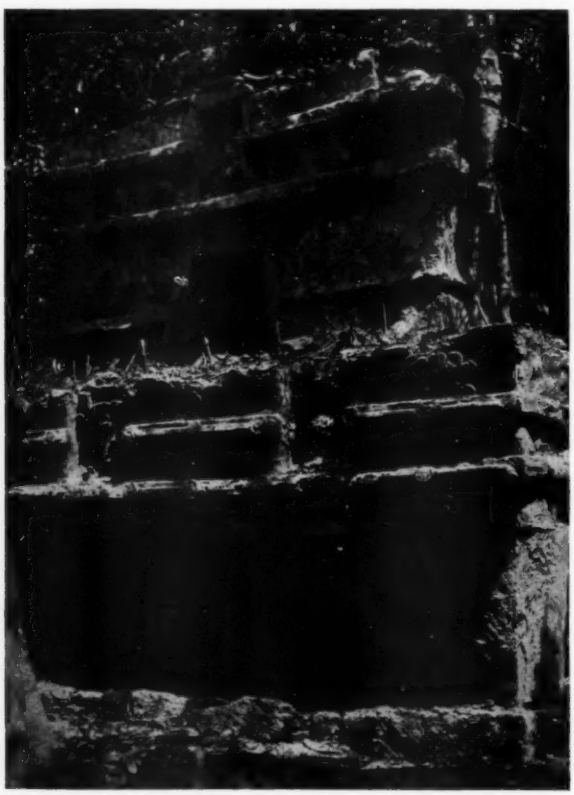
The hieroglyphic monument was found where Dr. Howe had left it on the beach, and its inscription was drawn and photographed. His reading of the date, "9.6.10.0.0 8 Ahau 13 Pax," approximately 290 A.D., was verified, thereby developing an exceedingly complex problem. The occurrence of such an early date as 290 A.D. at such an obviously late Maya city as Tuloom is difficult to explain. Geographically, architecturally, stylistically, and historically considered, Tuloom is a thousand years later than the date on this monument. Indeed, barring this one early date, there is nothing at Tuloom to connect it with the Old Empire; on the contrary, its location, art, and architecture strongly indicate that it is to be referred to the close of the New Empire, probably after 1200 A.D.[2] This

1 In the accompanying color reproductions, the background color, a deep purplish red, has been omitted in order to simplify the designs. In the originals the black outlines and the more delicate pale blue decorations are almost lost against the solid darker color of the background.

2 Dr. Gann, who has published tracings of wall paintings at Santa Rita Corozal that show a strong Nahua influence, probably felt subsequent to 1200 A.D., declares that the Tuloom and Santa Rita frescoes are very similar in treatment.

question is an important one, and further work will be necessary here before the apparent anachronism can be satisfactorily explained.

By specialization of work, it was possible to gather in four days sufficient data for a preliminary report on the site. Mr. Carpenter devoted himself exclusively to the photographic record, which involved considerable clearing. Dr. Gann spent all his time copying the mural paintings, while Mr. Lothrop made the observations for the map, ground plans, and elevations, and drew an excellent panorama of the site. The writer copied the inscription on the monument, drew the figure, and made the general archæological notes on the site. Dr. Underhill remained on the "Corozal" to watch the crew. These cowardly fellows, with but one exception, flatly refused to leave the boat, and spent the days and nights in discussing the "Indian peril," which was never acute. Dr. Gann and the writer slept on shore four nights without any untoward interruptions. Evidence of recent Indian visits to the ruins, however, was not wanting—meat-slings, broken turtle-eggs, and candle-drippings being found in several of the buildings.



"Temple 16" contains the best preserved wall paintings at Tuloom. These are on the inner walls of the outer corridor of the first story, and portray the deities of the Maya pantheon in acts of sacrifice. Niches over the doorways are filled with representations in stucco of the human figure. This temple shows several different periods of construction. Before a good photograph could be obtained, the roof of the first story had to be cleared of its screen of riotous vegetation

But at last work was over, and the moment for leaving the ruins had come. With profound regret all bade good-by to this romantic spot, so replete with memories of another time and people. Our incursion was but transitory, our noise of occupation, fleeting; and again the crumbling temples were left to the solitude of the bush, and its all-engulfing vegetation.

The "Corozal" weighed anchor, and put out past the reef to open sea. A norther was raging outside, and for the next twelve hours it was doubtful whether or not the ancient craft would weather the storm. Huge waves crashed over her bows, and all but beat her to the bottom. She lost her copper sheathing and when within some ten miles of Belize, her coal gave out. Fortu-

THREE DETAILS OF MURAL PAINTINGS IN "TEMPLE 16"

The large full figure in the center holds in his hands a baton, which seems to have been the chief emblem of divine authority at Tuloom, since it is carried by most of the deities in the wall paintings. The head to the right represents one of the leading members of the Maya pantheon, a god associated with rain and fertility. The head to the left is that of Itzamna, the sun deity, patron of the calendar, chronology, and hieroglyphic writing. In the Tuloom wall paintings the figures are outlined in blue and black against a purple background

nately the sea had fallen sufficiently to enable the crew to put off in the dory to a key nearby where mangrove wood was cut, and with scarcely enough fires to keep steam up, she crept into Belize one morning, after an absence of eight days.

This small temple, standing a few hundred yards outside the walls to the north, presents a feature common in Maya architecture—namely, the roof comb, a wall purely decorative in purpose and usually embellished with an elaborate design in stucco

---

On the coast of Yucatan,[1]
As untenanted of man
As a castle under ban
By a doom,
For the deeds of bloody hours,
Overgrown with tropic bowers,
Stand the teocallis towers
Of Tuloom.

One of these is fair to sight,
Where it pinnacles a height;
And the breakers blossom white,
As they boom
And split beneath the walls,
And an ocean murmur falls
Through the melancholy halls
Of Tuloom.

Here are corridors, and there,
From the terrace, goes a stair;
And the way is broad and fair
To the room
Where the inner altar stands;
And the mortar's tempered sands
Bear the print of human hands,
In Tuloom.

We are tenants on the strand
Of the same mysterious land.
Must the shores, that we command,
Reassume
Their primeval forest hum,
And the future pilgrim come
Unto monuments as dumb
As Tuloom?

[1] These stanzas are from the poem "Tuloom," by Erastus W. Ellsworth, 1855

The Eulachon—and its Kindred

A DELICIOUS FOOD FISH WHICH, BY ITS ABUNDANCE AND CONSEQUENT LOW MARKET PRICE, IS MAKING "A NICK IN THE HIGH COST OF LIVING IN THE NORTHWEST"

By DAVID STARR JORDAN

THE finest food fish in the world, tender, fragrant, digestible, is the eulachon (*Thaleichthys pacificus*), known to the trade as the "Columbia River smelt." It belongs to the smelt family (Argentinidæ), but it differs widely in habit and substance from the two species of smelt found on the two shores of the North Atlantic, and its nearest relative is the capelin of arctic and subarctic waters.

The eulachon has much smaller scales than the true smelt. Its flesh is more tender, more substantial, and at its best extremely full of oil, but this oil, unlike that of the mackerel and the salmon, is very delicate, and very easy of digestion.

The eulachon is a slender fish, dusky olive in color, about eight inches in length. It is found on the Pacific Coast from Sitka to Monterey Bay, entering the mouths of the rivers to spawn in midwinter, and not going far out to sea at any time. The spawning males have little warty edgings on the scales, making them velvety to the touch. The eggs are very small and white, deposited by the thousand between tide marks on the sand of the river mouths. Just now, February, 1917, the beaches at the mouth of the Columbia are lined with these fishes. They can be shoveled up and shipped in boxes; they sell at three to five cents a pound in Portland. These are spent fish. Probably they would die, even if put back into the sea. Whether any survive the spawning act is uncertain. To die after spawning, the protoplasm in the cells being exhausted as in a dead cornstalk, is a common attribute of many fishes in the Pacific. The six species of salmon, the Japanese icefish (*Salangichthys*), and the capelin (*Mallotus*), all perish after the first sex impulse. For this reason, the eulachon is at its worst when it comes into the market, soft, mealy, and with scanty oil. Even then, no fish is better, and at the ruling prices it makes a nick in the high cost of living in the Northwest.

It is said that when a eulachon is at its fattest, in the fall, a wick can be drawn through the body and it will burn like a candle. Hence it has been called in books (nowhere else) "candlefish." The Indians of southern Alaska carve vats in the rocks, fill them with eulachon, and with hot stones try out the oil, which they greatly appreciate. But the oil extracted from rotting fish has an odor of its own which it takes a hardened Indian to appreciate.

The Indian name of the fish, as I have heard it among the Chinooks, I should spell "oulchn." But one of the early explorers wrote this same word "eulachon," which is quite pronounceable and has a Greek look, and this name should be kept, not lost in the expressionless "Columbia River smelt." The species was first named by Sir John Richardson in the *Fauna Boreali-Americana,* in 1836. But in the notebook of William Clark of the Lewis-

Clark Expedition about 1805, we find this memorandum, accompanied by a fair pen sketch of the fish:

"I think them superior to any fish I ever tasted, even more delicate and luscious than the white fish of the Lakes which have heretofore formed my standard of excellence among the fishes. I have heard the fresh anchovy much extolled but I hope I shall be pardoned for believing this quite as good. The bones are so soft and fine that they form no obstruction in eating this fish."

The capelin (*Mallotus villosus*) is very much like the eulachon, a little larger in size, and in the males some of the scales in rows, are produced, making the whole surface of the fish woolly to the touch. This is a northern fish, native to Greenland, Siberia, and Alaska; and to the Indians and the Eskimos, both in Greenland and Alaska, it is of the greatest food value. It spawns in the surf, and the falling tide leaves it by the million on the islands of southern Alaska. It lines the beaches in summer as the eulachon farther south does in the winter. But the eulachon chooses the river mouths while the capelin is satisfied with any sandy beach.

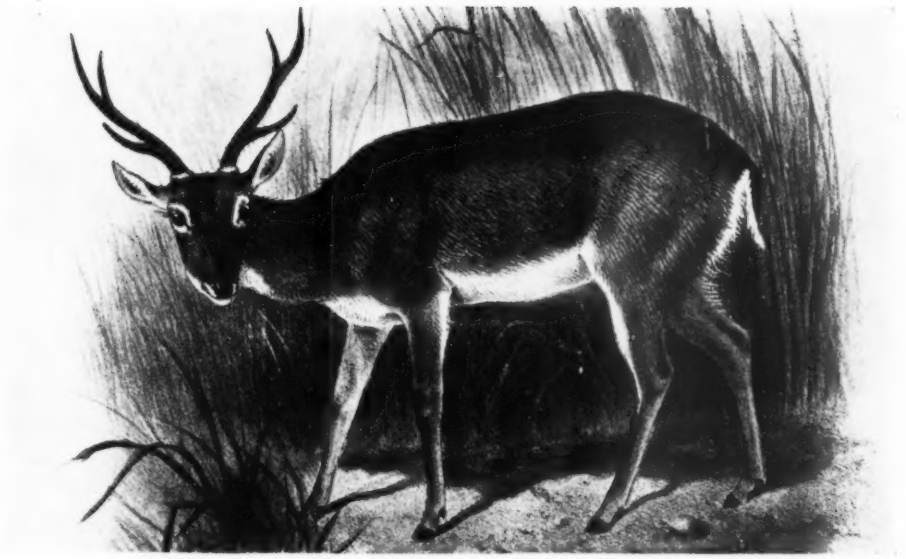
The little icefish or whitebait (*Salangichthys*) of the rivers of Japan runs in the summer time in the streams. It is a small, tender, translucent creature not three inches long, but it has the salmon habits, and the delicate flavor of the smelt. We suppose this to be its life history, although the details are not proved. It runs in the summer and casts its spawn in the brooks. The young fish slip down to the sea in the fall, tail-foremost, "in the old salmon fashion," and, as we believe, they return the next summer to spawn and die. If this be true, it is an annual fish, each generation renewed each year from the eggs of the one before.

Another little transparent "smeltling" is the New Zealand whitebait (*Retropinna*). This is now largely canned as a food product, the flavor of the preserved flesh being excellent.

Of the true smelt (*Osmerus*), with large loose scales and sharp teeth, Europe has one species (*Osmerus eperlanus*), and eastern America another (*Osmerus mordax*). The North Pacific is better supplied. One species (*Osmerus thaleichthys*) is common in California. A larger and finer one, the surf smelt (*Hypomesus pretiosus*), spawns in the surf northward, and the pond smelt of Alaska (*Hypomesus inghaghitsch*) spawns in brackish ponds northward. The rainbow smelt (*Osmerus dentex*) is common in the north, and a species large and rare (*Osmerus albatrossis*) lives near the surface in the open sea. Another, with feebler teeth (*Spirinchus verecundus*), clings to the streams of Korea.

None of these is so remarkable as the fur seal smelt (*Therobromus callorhini*), in the open sea about the Aleutian Islands. Of this dainty little fish no naturalist has ever seen a perfect specimen, but the tender bones have been taken by the thousand from the stomachs of fur seals feeding out in the sea. Dr. Frederic A. Lucas has made a restoration of this animal as if it were a fossil.

Other fish of the smelt kind, *Microstoma* and *Nansenia,* are found in the deep seas of the Arctic, and still others, called *Argentina,* in deep waters farther south. The whole group seems to be an offshoot of the trout and salmon race, carrying the adipose fin, the badge of all that race, as well as of the wholly unrelated race of the catfishes. This fin is probably a remnant of a once continuous fin-fold which existed before it was stiffened up with fin-rays.



Modern pampas deer [From Lydekker's *Deer of All Lands*]

A Fossil Deer from Argentina

WITH A DISCUSSION OF THE DISTRIBUTION OF VARIOUS TYPES OF DEER IN NORTH AND SOUTH AMERICA

Skeleton in the American Museum of an extinct species of deer from the Pampean formation of Argentina

By W. D. MATTHEW

AMONG the gems of the Cope Pampean Collection is a nearly complete skeleton of the fossil deer, *Cervus* (*Blastocerus*) *pampæus*. It was found in the Pampean formation near Buenos Aires by Florentino Ameghino nearly forty years ago, and was among the many buried treasures found among Professor Cope's collections. This handsome deer was a contemporary of the various strange extinct types of the Pampean fauna of Pleistocene age, of the great ground sloths, toxodonts and *Macrauchenia*, but it is a close relative of the living pampas deer *Blastocerus bezoarticus*, and indeed is barely to be distinguished from it. Like the pampas deer, the antlers are three-tined in the full-grown buck, and have neither "brow tine" nor "sub-basal snag."

This skeleton is probably unique. At all events I have not seen any description or reference to a fossil deer skeleton from the Pampean in all the published memoirs and minor articles dealing with this remarkable fauna. Various deer remains have been described and figured, but all of them fragmentary—antlers, jaws, and the like, mostly of rather doubtful status. The species *Cervus pampæus* was originally named by Bravard, apparently from fragmentary material, but this skeleton has remained unknown to science.

The specimen was mounted in 1915 by Mr. A. Hermann, using, as a guide to form and pose, the photograph of a modern pampas deer published by Lydekker in *Deer of All Lands*. The skull had been rather crudely restored, probably at the Paris Museum for the Exposition Universelle in 1878, but many small fragments and the more delicate parts of the skull had been left unrecognized

among the fragments of the skeleton. Careful and thorough piecing has enabled us to make a much more complete and more accurate reconstruction of the skull, and to reconstruct the skeleton with but little missing

Fossil skeleton of extinct deer, found forty years ago in the Pampean formation near Buenos Aires, and now mounted in the American Museum. This animal was a contemporary of the great ground sloths, toxodonts, and other curious extinct creatures that inhabited South America in Pleistocene times

and practically nothing of any importance doubtful, save as to the vestiges of the side toes, of which no remains could be found although they were presumably present in the skeleton.

Geologically speaking, deer are rather recent arrivals in the South American continent. They are not found in the Tertiary formations, and make their appearance first at the end of the Pliocene and in the Pleistocene (Pampean formation). They were invaders from North America, accompanied by mastodons, camels, peccaries, horses, and tapirs, and by saber-toothed tigers and other northern Carnivora. This invasion seems to have been made possible by the union of the two Americas at Panama and the raising of the isthmus to a height considerably above its present level, aided by a lowering of tem-

peratures even in the tropics, due to the oncoming glacial period. It resulted not only in a great invasion of the northern fauna into South America, but also in a not inconsiderable invasion of the native South American fauna into Central and North America. In the final outcome the invaders from the south were unable to maintain their footing and mostly became extinct, while the northern colonists in South America eventually supplanted the native fauna in great part. To-day the only remains of the southern mammal fauna are a few edentates (sloths, anteaters and armadillos), a large minority of the rodents, and perhaps some or all of the monkeys, bats and opossums. The rest of the mammals are animals whose Tertiary ancestors lived in North America but not in South America.

Among these last must certainly be listed the deer. Yet the distribution of these ruminants is a curious one, not easily explained. In the northern half of North America range the largest and most progressive of the deer tribe, the wapiti, caribou, and moose, closely related to species of the northern Old World. Overlapping their range and stretching to the southward as far as the highlands of Central America and Colombia is the *Odocoileus* or Virginia deer group of species, with forked antlers of three or more tines, distinguished from most of their Old World relatives by the absence of a brow tine. The place of the brow tine is partly supplied by another tine known as the sub-basal snag; but its relations to the beam are different from those of a true brow tine.

Throughout tropical South America and Central America the only deer are the brockets, little fellows much smaller than the Virginia deer and with simple spikelike horns. Far to the southward we again meet with larger deer with complex antlers, inhabiting parts of southern Brazil and Bolivia, Chile, and Argentina south to the Strait of Magellan. These deer lack the brow tine, but unlike *Odocoileus* they also lack the sub-basal snag. In the guemals of the mountain districts the antler is simply forked; in the pampas deer the hinder fork is again divided, and in the marsh deer it is a little further complicated.

All these southern deer look a good deal like the Virginia deer group of the north, and they are in fact related to them more nearly than to most of the Old World deer. The relationship is not so close, however, as it at first seems to be, and it has been found necessary to separate them as distinct genera, the guemals under the very unsuitable name of *Hippocamelus* (for they have nothing to do with either horse or camel), the pampas and marsh deer under the name of *Blastocerus*. These two genera might very well be united into one, but we will follow the customary usage. Their affinities to the Virginia deer are thought to be due to common descent from some smaller simpler type, pretty closely represented by the brockets (*Pudu*). (The name brocket, belonging originally to a young animal of the red deer, is applied by naturalists to these small forms which never get beyond the spike-horned stage.)

This distribution is not very easy to account for. We might suppose that the brockets first penetrated into South America and that in the far south they evolved into guemals and pampas deer, while in temperate North America they evolved into the true Virginia deer. But the palæontologic record does not seem to support this view. The earliest fossil deer of the Argentine found in the Monte Hermoso formation (late Pliocene) were already moderately large and had complex antlers, while in the Pampean (Pleistocene) they were fully as large and the antlers fully as complex as any modern types. Lydekker suggested that the brockets are degenerate descendants of Pleistocene invaders with complex antlers which were the original invaders of South America; but it is difficult to see any reason for such degeneration. Probably a better understanding of the affinities of the later Tertiary deer of North America would afford some clues, but it must be admitted that as yet these are very imperfectly understood. We do not know for certain whether the Virginia deer group arose in North America or immigrated from the Old World; it has not been positively recognized in formations earlier than the Pleistocene.

Until better evidence is obtained from the fossil record, the best clues to the derivation of these South American deer are perhaps to be found in Dr. Frank M. Chapman's researches upon the geographic and zonal distribution of the fauna, especially the bird fauna, of Colombia. These point apparently to geographic or climatic conditions during

TITIAN RAMSAY PEALE, NATURALIST AND ARTIST

From the painting in the possession of the American Museum. The description designates this painting an "Oil Portrait of T. R. Peale by himself with a little help from his brother Rembrandt"

the late Pliocene or Pleistocene which enabled animals adapted to temperate climate to cross the isthmus and penetrate into South America, and to their subsequent isolation in the mountain zones, separated from their northern relatives by a wide belt of tropical lowlands which they cannot—or at all events do not—cross. Whether this occurred through a rise of the isthmian ridge to a much higher level than at present, bringing it within the zone of temperate climate along its whole length, or through a lowering of temperature in tropical regions during the glacial stage, bringing the zone of temperate climate down near to sea level in the isthmian region, or to a combination of both factors, may be left unsettled. Some such explanation seems to be needed to account for the distribution of the Colombian birds. What would its effect be upon the mammal fauna? Naturally it would enable the late Tertiary deer of temperate North America to find their way along the highlands southward until they reached temperate South America, where they would spread out and flourish in a congenial and extensive region. At the same time the tropical deer of Central America and the Gulf Coast would spread into tropical South America. Through the subsequent isolation the northward range of the southern types was limited, and in North America they had already been replaced by *Odocoileus*, working its way down from the north as early as the beginning of the Pleistocene, and reaching as far as Colombia before it was cut off by the climatic isolation of temperate South America.

Obviously if this be the real history of the dispersal, we ought to find in the late Tertiary of the Western States the ancestors of the guemals and pampas deer; in an older Tertiary stage we ought to find brockets, while the ancestors of the Virginia deer group should be discovered in the late Tertiary of northwestern Canada or possibly of Alaska. These are matters for future collecting and research to solve; they will provide the test for the soundness of the hypothesis here outlined.

A Forgotten Naturalist

By FREDERIC A. LUCAS

HOW many of us think of Titian Ramsay Peale as a prominent naturalist? How many of our younger men have even heard of him? The writer pleads guilty to having thought of him only in connection with the exhumation of "Peale's Mastodon," one of the first fairly complete skeletons to be rescued from the ancient elephant burying ground that lies back of Newburgh, whence have come most of our good specimens; and but for the fact that in 1915 the Museum acquired some of Peale's paintings, together with the drawings and manuscript of his projected work on North American butterflies, he would have been still further overlooked. Yet Peale was sufficiently well known to have been appointed one of the naturalists of the Wilkes Exploring Expedition to the South Seas (which extended over the years 1838–39–40 and 42), in company with James D. Dana and Horatio Hale, and was attached first to the "Peacock," and after the loss of this frigate, to the "Vincennes."

Peale's scientific career began early, for when only seventeen he was elected a member of the Philadelphia Academy of Natural Sciences, and, in company with Thomas Say and George Ord, visited the Sea Islands and eastern Florida, which at that time still belonged to Spain. Immediately after this he was appointed assistant naturalist to Major Stephen H. Long's expedition to the Rocky Mountains, which added some sixty new species of birds and mammals to our known fauna, besides obtaining large and varied collections of plants and insects. Finally, in 1870, he figured as one of the founders of the Philosophical Society of Washington.

That Peale is so little known in spite of his activity and the very considerable amount of work accomplished by him, is probably due to the fact that he published

very little. His report on the zoölogy of the Wilkes Expedition was practically suppressed,[1] and for some unknown reason he was not allowed to consult the collections he had made, nor to use any of the large number of colored plates prepared by him, although later John Cassin was permitted to do both. Of a projected work entitled *Lepidoptera Americana*, only a single part was issued, in 1833; while his *Lepidoptera of North America* was never completed. This manuscript, with its accompanying volumes of plates, is among the material secured by the American Museum, through the interest of its librarian, Dr. R. W. Tower.

An excellent portrait of Peale is one of the most important of the paintings secured by the Museum, the others being sketches made during the course of the Wilkes Expedition. The paintings intended for plates in the *Lepidoptera of North America* are admirably done, and in many cases portray the various stages in the metamorphosis of the insect. The text was to be very comprehensive and to pay especial attention to habits—a branch of zoölogy still sadly neglected. Too many of our younger naturalists seem to look upon the making of species and subspecies as the principal object of zoölogy, whereas these are merely bricks from which master hands may construct many an edifice of fact or theory.

As evidenced by this manuscript, Peale's style was interesting and had the literary flavor that is too often lacking in modern zoölogical papers—another too common mistake being to think that, because a paper is full of little-known technical terms, it is necessarily scientific.

Those who look in encyclopedias for information in regard to Titian Ramsay Peale will find little more than that he was the fifth and youngest son of Charles Willson Peale, a man a century in advance of his time. Rembrandt Peale, another son, is deemed worthy a place in encyclopedias, but the records omit mention of other members of the family.

Dr. Witmer Stone, of the Philadelphia Academy of Sciences, who has rescued many interesting facts from undeserved oblivion, has written a biography of Titian Peale; also a brief sketch of his life and works, written by his relative, A. C. Peale, will be found in the *Bulletin of the Philosophical Society of Washington*, Vol. XIV, pp. 317–326.

[1] An abridged copy of this, in Peale's handwriting, is among the material obtained by the Museum.

Museum Notes

SINCE the last issue of the JOURNAL, the following persons have become members of the Museum:

Fellow, LOUIS T. HAGGIN.

Life Members, MRS. WILLIAM H. CROCKER, MRS. FREDERIC S. LEE, and MESSRS. R. CLIFFORD BLACK, GEORGE A. CROCKER, JR., WILLIAM LOUIS GARRELS, IRVING B. KINGSFORD, ALFRED F. LICHTENSTEIN, MALCOLM S. MACKAY, EDWARD MALLINCKRODT, JR., GEORGE D. ROSENGARTEN, VALENTINE P. SNYDER, and BENJAMIN L. WEBSTER.

Annual Members, MRS. J. C. BERNHEIM, MRS. RANSOM S. HOOKER, MRS. ROGER W. STRAUS, MISS META EILERS, and MESSRS. CHARLES D. BARRY, MORTON G. BOGUE, W. ASHLEY DEWOLF, JOHN H. FLAGLER, STEPHEN B. FLEMING, EDGAR E. FRANK, ALBERT GREENBERGER, HARRY F. GUGGENHEIM, CHARLES J. HARDY, J. B. HAYWARD, GEORGE C. HECK, PETER COOPER HEWITT, N. C. KINGSBURY, WILLIAM T. KOCH, ARTHUR LIPPER, STEPHEN C. MILLETT, C. E. MITCHELL, PHILIP A. MOSMAN, J. R. OGDEN, STUART H. PATTERSON, O. B. PERRY, CARROLL J. POST, JR., FORREST RAYNOR, FRANCIS J. REBMAN, ALLEN MERRILL ROGERS, SAUL E. ROGERS, WALTER E. SACHS, ARCHIBALD G. THACHER, THEO. F. WHITMARSH, and EDWARD W. WOOLMAN.

SIR ERNEST SHACKLETON was elected an Honorary Fellow of the American Museum of Natural History at the regular meeting of the executive committee of the board of trustees on March 21, in appreciation of his work in geographical research and in recognition of his splendid service to science and to humanity.

THE celebration of the centennial of the New York Academy of Sciences, which was to have been held at the American Museum of Natural History during May, has been given up on account of the critical international situation. The original plan included a week's program, with men of science from this country and abroad as guests, and special exhibits at the American Museum. In the present crisis scientists are needed at home, even if they were willing to risk getting across the water. A one day's celebration will be held, however, sometime during May. At this meeting the emphasis will be laid on working for an endowment fund, which was to have been a feature of the celebration as originally planned.

DR. SAMUEL W. WILLISTON, professor of vertebrate palæontology in the University of Chicago, and one of the world's foremost authorities on fossil reptiles, recently visited the American Museum of Natural History to study particular fossil specimens, among them the skeleton of the giant bird from the Lower Eocene of Wyoming, brought back by the field party of the Museum last summer. A reconstruction of this bird is now being made by the department of vertebrate palæontology of the American Museum.

MR. J. T. NICHOLS is spending a few weeks on the southern coast of Florida, making collections for the department of ichthyology of the American Museum.

IF war does not interfere, the anthropological department of the Museum is planning extensive work in the Southwest during the coming summer. Mr. Nelson expects to do reconnaissance work over a large area of south central New Mexico in order to complete the survey of the ancient Pueblo region in which glazed pottery occurs; Mr. Leslie Spier will extend his archæological reconnaissance, begun at Zuñi in 1916, to the drainage of both the Little Colorado and the Gila rivers in Arizona; and Mr. Earl H. Morris, a graduate student at Columbia University, will proceed with the excavations of the famous Pueblo ruin at Aztec in northwestern New Mexico.

THE meeting for 1917 of the American Association of Museums is to take place in New York City, May 21–23, closely following the date of the meeting of the American Federation of Arts in order to allow museum representatives from different parts of the country to attend both conventions during the same railroad journey. At the Washington meeting last May, it was suggested that the subject for consideration at the next meeting should be the "Preservation and Care of Museum Specimens," and papers on that subject may now be registered with the secretary of the association, Mr. Paul M. Rea. The American Museum of Natural History is to serve as headquarters for the meeting.

DR. BASHFORD DEAN left New York March 7 on a business trip to the Far East in behalf of the American Museum of Natural History and the Metropolitan Museum of Art. He went by way of Vancouver, stopping along the route at several points to deliver lectures. His original plan included visits to Japan, China, and Australia, but the war situation has curtailed this to a brief stay in Japan, with a return to New York about June first.

ON March 26, Mr. Alessandro Fabbri, in collaboration with Mr. Charles F. Herm, both of the department of physiology of the American Museum, exhibited to the scientific staff of the institution a new film on the embryonic circulation of the chick. The pictures showed a heart at so early a stage in the development that it was transparent, which, by its rhythmic contractions, forced the blood into the adjacent arteries; an isolated heart from an eight-day-old embryo, beating rhythmically outside the body planted in a tissue culture; and a minute section from the same heart growing in normal plasma. One could see the circulation in the body of the young embryo, and again in the large vessels which bring oxygen and nutrition from the yolk area; also the fine anastomoses between two blood vessels—nature's method of feeding the tissues in case one of the regular supply channels is cut off. Particularly remarkable was the demonstration of rapid circulation in the arteries and slower circulation in the capillaries. Mr. Fabbri also showed a series of motion pictures on the formation of crystals by evaporation. These micro-cinematographs will be of the greatest educational value in presenting graphically to high school and college classes some of the details of biological science.

DR. FRANK M. CHAPMAN was elected an honorary member of the British Ornithologists' Union, at the annual meeting of the society, held on March 14, in London. The membership of the Union, according to its printed rules, includes "ordinary members," elected by ballot of the society; not more than ten "honorary members," to be recruited from eminent ornithologists residing abroad; "colonial members" from the British Colonies and India, also not to exceed ten; and "eminent foreign ornithologists," not to exceed twenty. Before his election as an honorary member, Dr. Chapman had been one of the twenty in the last-mentioned group.

THE bay of Rio de Janeiro, Brazil, shown on the cover of the present JOURNAL, is one of the most beautiful in the world. Tall, barren rocks rise from the bottom of the ocean, and tower above the waves, like giant monoliths. One of them, the famous Pão d'Azucar, or Sugar Loaf Rock (at the right in the picture), attains a height of twelve hundred feet, and from its top, reached by means of an aërial cable car, one has a splendid view of the surrounding country. All ships entering the harbor must sail through the narrow passage in the center. A number of forts, some of which are clearly shown in the picture, protect the entrance and the approach to it. On the opposite side of the bay rise the Organ Mountains, one of the oldest ranges in South America. The peaks have weathered into splendid spires and pinnacles of fantastic shapes, and the entire range is much lower than in bygone ages. Dr. Frank M. Chapman and Mr. Leo E. Miller, of the South American Expedition of the American Museum, spent a short time in this region in the fall of 1916, and secured a collection which throws much light on the changing fauna of the Organ Mountains.

PROFESSOR HENRY FAIRFIELD OSBORN, president of the American Museum, has appointed an American Museum "public information committee," consisting of Dr. Frederic A. Lucas and Messrs. George E. Sherwood, George N. Pindar, and John W. Harrington. This committee will coöperate with the heads of the various departments for the purpose of supplying suitable matter for publication, regarding science and the activities of the American Museum, to newspapers and the technical and scientific publications of the country.

AMONG recent notable additions to the library of the American Museum are six volumes on costume, *Le Costume Historique*, published at Paris in 1888 under the direction of A. Racinet. The volumes are profusely illustrated, many plates being in color. The books take up the noteworthy types of dress, but also add details on interior furnishing, utensils, conveyances, and the like. Other interesting acquisitions are *Icones Ornithopterorum: A Monograph of the Papilionine Tribe Troides of Hubner*, Volumes I and II, London, 1898, by Robert H. F. Rippon, and *British Coleoptera*, Volumes I to VI, London, 1887 to 1913, by the Reverend W. W. Fowler. The library has also acquired the *Lepidoptera Britannica* by A. H. Haworth, London, 1803, which is rarely found complete, and Volume II of *The Iconography of Manhattan Island, 1498–1909*, by I. N. Phelps Stokes, New York, 1916, a beautiful volume compiled from original sources and illustrated by photo-intaglio reproductions of maps, plans, views, and documents in public and private collections.

THE department of anthropology has acquired by purchase from P. N. Breton a fine wampum belt from the Oka reservation in Canada. This belt had long been in the possession of the fathers of the Seminaire de Saint Sulpice, of Oka, Quebec, missionaries to the Iroquois and Algonquin Indians, and is probably the record of some land cession or treaty between the Indians and the missionaries. The belt is made of regular and beautiful shell beads, which may be of Dutch manufacture, and is ornamented with crosses and other geometric designs in white beads. It is in a state of preservation unusual for specimens of this kind.

IN exchange for American reptile material for exhibition, the American Museum has recently received from the Albany Museum, Grahamstown, South Africa, a collection of nineteen frogs and toads, twenty-seven lizards, and six snakes. Most of the species are new to the collections of the American Museum, and some are rare and little known, for instance, the gecko *Lygodactylus ocellatus*, and *Natalobatrachus bonebergi*, a frog belonging to a recently described genus. The Grahamstown collection sup-

plements a similar exchange from the Durban Museum, Natal, in giving an insight into the extraordinarily interesting and varied herpetological fauna of South Africa.

THE twenty-first annual entertainment of the City History Club of New York was held at the American Museum of Natural History on the morning of Washington's Birthday. Dr. George F. Kunz, first vice-president of the club, presided. The program included selections by the orchestra of the De Witt Clinton High School, songs, historical playlets, and dances by the Catherine Abbe, Joan of Arc, Elsie Rutgers, and Colonial Dames clubs, addresses by the officers of the City History Club and by the Honorable Robert Adamson, commissioner of the fire department, a letter from President Wilson, and motion pictures of the fire department of New York and of scenes from American history from Columbus to Lincoln. The audience joined in patriotic songs.

THE Chinese and Siberian hall of the American Museum has recently been reorganized. The cases, which before stood in isolated and rather confusing positions, have been set together so that they wall in the open space in the center of the hall. Visitors may now view the whole exhibit easily by following the course of the circle of cases. The present arrangement also makes better use of the windows in the hall. The exhibits themselves have been rearranged, and much new material has been added, particularly a number of specimens from Korea and Tibet. On both the Chinese and the Siberian sides of the hall, attention has been given to the display of textiles and embroideries, in consideration of the needs of the designers who are now turning to the Museum in search of new ideas.

THE Jesup collection of building and ornamental stones of North America, consisting of over one thousand specimens, has lately been rearranged according to the kinds of stones, instead of by states as in the old classification. This collection is in part a duplicate of the very extensive series in the National Museum, which was prepared under the direction of the officers of the tenth census of the United States, and was exhibited at the Centennial Exhibition at Philadelphia in 1876.

THE department of anthropology has purchased from Mr. David I. Bushnell a series of valuable objects, including one hundred baskets, the work of the Alibamu, Attacapa, Chitimacha, and Choctaw Indians of the lower Mississippi region. The baskets are made of a peculiar type of split reed, and are now so scarce as to be difficult to obtain. Other recent acquisitions of Indian material are a painted buffalo robe, probably from the Plains Ojibway, purchased from Mr. J. Alden Loring; ethnological specimens of the Micmac and other eastern tribes, purchased from Dr. Frank G. Speck; and a Blackfoot beaver bundle, purchased from Arthur J. Walters. The department has also purchased an unusually large and fine piece of Hawaiian tapa, a fabric which has been rendered rare by the rapidity with which the people of the Hawaiian Islands have given up their native ways.

A SPECIAL illustrated lecture for Museum members and invited guests, which attracted a large audience, was given at the American Museum of Natural History, Wednesday evening, March 28, under the joint auspices of the American Museum and the American Scenic and Historic Preservation Society. Mr. Samuel Christopher Lancaster, highway engineer and author, and a forceful and fluent speaker, delivered an address on "The Scenic Beauty of Oregon," illustrating his description with pictures from photographs taken by himself and two other enthusiastic mountain-climbers, and views made direct from nature by the Paget process. Mr. Lancaster was consulting engineer in the location and construction of the remarkable highway built by Multnomah County, Oregon, and dedicated in 1916. This highway, which extends for a distance of forty-two miles from Portland along the gorge of the Columbia River, through some of the most wonderful scenery in the United States, was characterized by General George Goethals, who passed over it in 1915, as "absolutely without equal in America for scenic interest." The purpose of Mr. Lancaster's address was to illustrate the great possibilities of scenic highways in America, when undertaken by enlightened and appreciative public authorities, as well as to depict upon the screen some of the extraordinary landscape beauties of the Cascade Range.

MR. H. E. ANTHONY has returned from the expedition to Cuba. The revolution there cut short his search for fossil mammal material, and small guerrilla bands of rebels

rendered the eastern end of the island unsafe for collecting. Fortunately, when the revolution broke out, Mr. Anthony was in a locality rich in possibilities, so that in spite of being prevented from moving about freely, he was able, by making the best of this one spot, to secure a number of desirable fossils, as well as specimens of the Cuban rat, *Capromys*, and a small collection of bats. The work was considerably furthered by the coöperation of the officials of the Spanish-American Iron Company, who gave the party free transportation on their tug and railroad. Also, the members of the expedition were made welcome at one of the mines, Daiquiri, where quarters and horses were furnished free of charge. Most of the material brought back is new to the Museum collections, and some of the fossils will probably prove new to science.

THE department of anthropology has received from Mrs. Wm. Tod Helmuth an ancestor tablet from China. The Chinese keep ancestor tablets on a shelf in the living room, and frequently put before them offerings of food and incense. These tablets are regarded with high reverence, because in them is supposed to reside one of the three souls which the Chinese believe each person possesses, while of the other two, one remains at the grave and the other goes to the unknown world of departed spirits. On account of their sacred character and family significance such relics are hard to obtain. This tablet, which is about a foot in height, is made of wood decorated with gilded carving. The central panel of the tablet bears an inscription in Chinese characters: "This is the dwelling of the soul of our maternal ancestor named Aunt Khek Ugô whose maiden name was Jap. Her dutiful son Se-choan worships."

AN important recent publication of the American Museum is *A Bibliography of Fishes*, Vol. I, by Bashford Dean, edited and enlarged by C. R. Eastman. It comprises 714 pages, and consists of references to the entire scientific literature of fishes, arranged under the names of authors from A to K inclusive. Vol. II, now preparing, will complete the references, the total number of which is estimated to be upwards of forty thousand titles. No other group of the animal kingdom has been so exhaustively treated in a bibliographical way as are the fishes in this undertaking, which was begun by Dr. Dean twenty-five years ago, and has been steadily carried on by him, largely as a personal matter, ever since. The Museum, out of recognition of the usefulness of the work, has provided for the publication of the two volumes and of a forthcoming subject index to them.

PROFESSOR HENRY E. CRAMPTON has published, through the Carnegie Institution at Washington, the first volume of an extensive and important work entitled *Studies on the Variation, Distribution, and Evolution of the Genus Partula.* The volume just issued, which deals with the species inhabiting the island of Tahiti, is the result of ten years' study. It will be followed by other volumes dealing with the species inhabiting other Pacific islands. Professor Crampton's work is based on personal explorations and observations in Tahiti and the neighboring islands of the Society group, conducted under the auspices of the American Museum of Natural History and the Carnegie Institution of Washington, during the years 1906, 1907, 1908 and 1909, in the course of which extensive collections embracing eighty thousand specimens were obtained from over two hundred valleys in the Society Islands alone. The work was extended in 1909 to include the Cook, Tonga, Samoan, New Zealand, Fiji and Hawaiian islands. The land snails of the genus *Partula* are confined to the islands of the Pacific Ocean, and are especially abundant in the Society group, which is their geographical center of distribution. The various species of the genus exhibit a wide range of variation which is broadly correlated with their degree of isolation from the original center of distribution.

Professor Crampton has studied this genus not only with reference to individual characters, but also in connection with general biological conditions, geographical and topographical locations, and the meteorological and other external influences having a real or apparent effect on the species of the genus. Professor Crampton's volume will take its place as an important contribution to the study of problems of variation, geographical distribution, and evolution, as seen under natural conditions rather than in the laboratory.